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The AWA Journal

Quarterly Bulletin of the Antique Wireless Association®
Winter 2015, Vol. 56 / #1

Vladimir Zworykin shows off the first electronic TV circa 1929 (see "Television", page 54).

Published for the radio collector, historian, restorer and all vintage communications enthusiasts.

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Originally published as

THE OLD TIMER'S BULLETIN

OFFICIAL JOURNAL, ANTIQUE WIRELESS ASSOCIATION™

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Tyne Award.....Joe Knight
Television Award .....Richard Brewster

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Please write legibly. Enclosing an SASE speeds replies.

DUES AND ADDRESS CHANGES: AWA Membership, P.O. Box 421, Bloomfield, NY 14469-0421; (585) 392-3088; e-mail awamembership@rochester.rr.com. Dues: $35 per year in U.S.; $40 elsewhere. Life membership: $700 in U.S.; $800 elsewhere. Make checks payable to "AWA."

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Radio Ramblings
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Radio Rehab 101
Richard A. Parks

Television
Richard Brewster

The Vacuum Tube
Ludwell A. Sibley

The AWA Journal is published approximately four times a year by and for members of the Antique Wireless Association. AWA is a non-profit historical society founded in 1952 and incorporated in the State of New York. *The AWA Journal* is available through AWA membership. Its issuance is subject to change from time to time as to frequency, content, and size. It is not liable in any way for any buying-and-selling transaction entered into as a result of its content.

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FROM THE EDITOR

Two Noted Antique Wireless Historians Pass On

By coincidence, two well-known and widely-respected antique wireless historians have passed on within days of each other. In a recent phone call, Alan Carter of the British Vintage Wireless Society advised me that Gerald Wells, Founder of the Society and Curator of its museum, passed on December 22. As it happens Lauren Peckham, third President of The Antique Wireless Association and longest serving AWA board member, had passed a few days earlier on December 19th. The *Journal* extends its deepest sympathies to both families. There will be an article on Lauren and his many contributions to AWA in the Spring issue of the *Journal*.

Editor's PO Box to Close

These days, with most communications and manuscripts coming to me by e-mail, I've been visiting my PO box less and less. Finally, it looks like it's time to make the move and close it. Box mail will be forwarded to me at home for awhile. Those who would still like to communicate by snail mail are definitely encouraged to use my home address, which will be shown in the "Whom to Contact" section on page 2 beginning with this issue.

— Marc Ellis, N9EWJ
847-869-5016 • mfellis@alum.mit.edu

FROM THE DIRECTOR

This is the time of year that museum directors and board members review the past year's accomplishments and plan for the next year's work requirements and financial needs. In the case of AWA I prefer to consider the past several years because they have been so eventful.

We have received a remarkable number of donations of major collections as well as real estate gifts and generous cash contributions. I am happy to add to these with a lease for my properties that will delay the transfer of them to AWA and allow me to make payments for construction and maintenance. It will also cost me town and school taxes. This will conserve AWA cash and help start phase two of our museum.

I can't say enough about our/your all-volunteer work crews. They have traveled coast to coast to photograph, catalog, pack and transport donations to the museum. In addition, they have participated in regional meets and national meetings throughout the country. I am convinced that they are the reason for the growth of our current reputation, which has led to the gifts of major collections.

I close by wishing both AWA members and friends a Happy and Healthy New Year!

See you at next year's Convention!

Tom Peterson, Jr., *Director, AWA*

ABOUT OUR AUTHORS

P.A. KINZIE

Wireless Communication by Earth Conduction in The Early 1900s, Part 3 (final): Related Inventions and Business Efforts

Like many of us, Kinzie became fascinated with all things electrical as a pre-teen. He began serious reading on the subject and acquired an interest in crystal radios that is with him today.

He graduated from the University of Colorado in 1952 with a BS in Engineering Physics, then got a job in test engineering at Convair, later a division of General Dynamics, in San Diego. While working full time he enrolled in a night school graduate degree program at UCLA, earning an MS in Engineering in 1959. At Convair, he be-

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MEMBERSHIP NEWS

***AWA JOURNAL* POLICY ON PROMOTING EVENTS:** The *AWA Journal* is pleased to list the meets and meetings of any established antique radio organization, whether or not it is associated with the AWA. Send your information to Marc Ellis, Editor, *AWA Journal*, P.O. Box 1306, Evanston, IL 60204-1306. E-mail mfellis@alum.mit.edu. Closing date is six weeks prior to first day of month of issue.

Information About AWA and Other Events

AWA ROLLINS MEMORIAL DX CONTEST
March 4-5, March 7-8
See Amateur Radio column in this issue for full details.

CC-AWA ANNUAL CONFERENCE
March 25-28
More info in "With the Chapters" elsewhere in this column and on the Carolina Chapter's website at www.cc-awa.org.

TRI-STATE RADIO FEST
Sunday, May 3, 2015
The Pittsburgh Antique Radio Society is sponsoring its 11th annual Tri State Radio Fest on Sunday May3, 2015. The Antique Radio Flea Market and Auction will be held at the Center Stage Banquet Hall 1495 Old Brodhead Rd. Monaca Pa 15061. Vendor tables are available, with setup beginning at 6:30 am. Check in for auction items is from 9:00 am to 11:00 am. The auction will begin at 11:00 am. The featured contest is Atwater-Kent radios. The Main raffle prize is a fully restored Atwater-Kent 206. For more detailed information please visit our website: www.PittAntiqueradios.org or call Chris Wells at 724-942-1113.

AWA ANNUAL CONVENTION
August 11-August 15
Dual theme: Voice of America and Short Wave Listening. More Info in "Convention Doings" elsewhere in this column and on AWA's website at www.antiquewireless.org.

Recurring Meetings

• The Antique Radio Club of Illinois (ARCI) — Meets bi-monthly. Meets generally held at the American Legion Hall, Carol Stream IL but meets in June in conjunction with the 6-Meter Club of Illinois at the DuPage County Fairgrounds and once per year for Radiofest at the Willowbrook Illinois Holiday Inn. Check website for schedules, details and maps.) Contacts: President, Olin Schuler oshuler@comcast.net; Club Public Contact, Art Bilski, 630-739-1060, clubinfo@antique-radios.org. Website www. antique-radios.org.

• Antique Radio Collectors of Ohio — meets first Tuesday of each month at 2929 Hazelwood Ave., Dayton, OH (4 blocks east of Shroyer Rd. off Dorothy Lane) at 7 p.m. Also annual swap meet and show. Membership: $10.00 per year. For more info, contact Karl Koogle: mail to above address; phone (937) 294-8960; e-mail KARLKRAD@ GEMAIR.COM.

• California Historical Radio Society — For info on current meetings, call the CHRS hotline: (415) 821-9800.

• CARS, the Cincinnati Antique Radio Society — Meets on the third Wednesday of each month at Gray's History of Wireless Museum, which is part of The National Voice of America Museum of Broadcasting, Inc., located in a building that is now

AWA NETS (EASTERN TIMES)

SUNDAY:
7237 kHz, SSB, 12 noon, NCS: Various
3840 kHz, AM, 7PM held only during EDT
3837 kHz, AM, 4PM held only during EST
NCS: Joe, W3GMS

MONDAY:
1945 kHz, SSB or AM, 8PM, NCS: N3IBX

MONDAY-WEDNESDAY-FRIDAY:
The AWA Bruce Kelley Memorial Net
3837 kHz, SSB, 9:30AM
NCS Monday, Jeff-W3JW
Wednesday, Roy-W2TWS
NCS Friday, Doug-WA3DSP

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AWA LIFE MEMBERSHIPS ARE NOW AVAILABLE

Cost: $700 (U.S.), $800 (elsewhere.) Make out your check to Antique Wireless Association and send it to AWA Membership, P.O. Box 421, Bloomfield, NY 14469-0421. E-mail awamembership@ rochester.rr.com.

on the National Historic Register at 8070 Tylersville Road, Westchester, Ohio. 45069. For more information contact Bob Sands at (513) 858-1755.

• Carolinas Chapter of the AWA — Hosts four "mini-swap-meets" each year (in January, May, July and October) plus an annual conference, "Antique Radio Charlotte," on the 4th weekend in March. Executive committee meets approximately quarterly. For more info, visit the website at CC-AWA.ORG or contact Ron Lawrence, W4RON, Chapter President, P.O. Box 3015, Matthews, NC 28106-3015; phone (704) 289-1166; e-mail W4RON@carolina.rr.com.

• Central Ohio Antique Radio Assn. – Meets on the third Wednesday of March, June and September at 7:30 p.m. Swap meets: "Cabin Fever" in January and outdoor tailgate in July. December Christmas party. For more info contact Barry Gould at 614-442-1518 or Dave Poland at 614-890-5422 or http://coara.org/.

• Delaware Valley Historic Radio Club — Meeting and auction begins 7:30 p.m. on the second Tuesday of each month. Location: Telford Community Center on Hamlin Ave. in Telford, PA. Annual dues: $15.00, which includes a subscription to the club's monthly newsletter *The Oscillator*. For more info contact Delaware Valley Historic Radio Club, P.O. Box 5053, New Britain, PA 18901. Phone (215) 345-4248.

• Houston Vintage Radio Association (HVRA) meets the fourth Saturday (January thru October) at Bayland Park 6400 Bissonnet, 9 a.m. in SW Houston. Each meeting includes an auction and program. Annual two-day convention held in February includes three auctions, old equipment contest, technical talks, swap meet, and awards banquet. One day MEGA auctions held in the spring and fall. A newsletter, *The Grid Leak*, is published bi-monthly. Event postings, announcements, photos and other features are available on HVRA website: www.hvra.org. Membership is $20/yr. Address: HVRA, P.O. Box 31276, Houston TX 77231-1276 or call Bill Werzner, 713-721-2242; email: werz1943@gmail.com.

• Hudson Valley Antique Radio and Phono Society [HARPS] meets the 3rd Friday of the month 7:30PM at the Episcopal Church of Suffern Annex, 65 Washington Ave., Suffern N.Y. 10901 for info contact Rev. Dale Cranston at (845) 357-1615 or dale.cranston@gmail.com.

• Indiana Historical Radio Society — Active since 1971. Meets in Feb. (Lawrence), May (2-days, Kokomo) and Oct. (Greenfield). Flea market, old equipment contest, and auction at all events. Meet details and club info at website www.indianahistoricalradio.org. $15.00 annual dues includes the IHRS Bulletin published quarterly. Contact Herman Gross, W9ITT, 1705 Gordon Dr., Kokomo, IN 46902, 765-459-8308, email w9itt@comcast.net.

• London Vintage Radio Club — This Ontario, Canada club meets in London on the first Saturday of January, March, May, and November. Annual flea market held in Guelph, Ontario in June. Contact: Dave Noon, VA3DN, 19 Honeysuckle Cr., London, ON N5Y 4P3, Canada. Email: va3dn@execulink.co. Website: http://lvrc.homestead.com/index.html.

• Mid-Atlantic Antique Radio Club (MAARC) — Meets monthly, usually on the third Sunday of the month at the Davidsonville Family Recreation Center in Davidsonville, MD. (But meets once or twice a year in Northern Virginia—check website for schedules, details and maps.) Contacts: President, Steve Hansman, 855 Arundel Drive, Arnold, MD 21012, (410) 974-0561, email: shans01a@ comcast.net; Membership Chair, Geoff Shearer, (703) 818-2686, email: gshearer2@verizon.net. Website www.maarc.org.

• The New Jersey Antique Radio Club — Meets the 2nd Friday of the month 7:30 p.m. at either Info Age 2201 Marconi Rd. Wall Township N.J. 07719 or Bowen Hall, Princeton University. We hold three annual swap

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meets and four seasonal repair clinics. Visit the club's website for details www.njarc.org or contact NJARC President Richard Lee (914) 589-3751 or president@njarc.org.

• Northland Antique Radio Club (Minneapolis/St. Paul) — hosts four events with swap meets each year (in February, May, September and November) including an annual conference, "Radio Daze," for two days in mid-May. Annual dues are $12.00, which includes a subscription to the club's quarterly newsletter. For more info, visit our website at www.northlandantiqueradioclub.com.

• Northwest Vintage Radio Society — Meets the second Saturday of each month at Abernethy Grange Hall, 15745 S. Harley Ave. Oregon City, OR. Meeting starts at 10:00 a.m. Membership $25.00 per year. Guests welcome at all meetings and functions except board meetings. Spring show, the second Saturday in May. For more information, contact Mike McCrow 503-730-4639; e-mail: tranny53@comcast.net.

• Oklahoma Vintage Radio Collectors — Meets second Saturday of each month, (except for April, October, and December), at Hometown Buffet, 3900 NW 63rd St., Oklahoma City, OK. Visitors welcome. Dinner/Socializing, 6 p.m., meeting, 7 p.m. Swap meets on second Saturday in April and October at 8 a.m., Midwest City Community Center, 100 N. Midwest Blvd., Midwest City, OK. Membership $15/year including monthly *Broadcast News*. Info: contact Jim Collings at (405) 755-4139 or jrcradio@cox.net. Website: www.okvrc.org.

• Ottawa Vintage Radio Club — Usually meets the second Wednesday of every month (except July and August) in the Conference Room, Ottawa Citizen, 1101 Baxter Rd., Ottawa, Ontario, Canada. Auctions in October and May. Call Paul Guibord (613-523-1315), or check www.ovrc.org for details.

• The Pittsburgh Antique Radio Society welcomes visitors to our Saturday flea markets, contests and clinics held at least four times yearly. A fall auction is included in September and our annual luncheon program is on the first Saturday in December. An annual Tri-State Radio Fest is held in April. Our journal, *The Pittsburgh Oscillator*, is mailed quarterly. For more information visit us at http://www.pittantiqueradios. org, email President Chris Wells at radioactive55man@comcast.net, or phone Treasurer Tom Dixon at 412-343-5326.

• Society for Preservation of Antique Radio Knowledge (SPARK) — Meets monthly at Donato's Pizzeria, 7912 Paragon Rd., Centerville, OH. Annual swap meet. Membership $15/yr. Write SPARK Inc., c/o Dan Casey, 10075 Morrow-Rossburg Rd., Pleasant Plain, OH 45162 or call Dan Casey at (513) 265-8466 or e-mail dansradioland@ gmail.com

• Texas Antique Radio Club — Meets alternate months in Kyle and Shertz, TX. Contact: Doug Wright, 625 Rolling Hills Dr., Canyon Lake, TX 78133. Email: dwjw@gvtc.com; website www.gvtc.com/~edengel/TARC.htm.

• Vintage Radio and Phonograph Society (VRPS) meets monthly on the third Saturday. Located in the Dallas, Fort Worth Metroplex, our current activities are annual convention, auctions, swap meets, repair training sessions and monthly programs. For details visit our website www.vrps.org, or by contacting VRPS President Jim Sargent at (817) 573-3546 or bsargent@swbell.net.

Convention Doings

AUGUST 2015
5 DAYS – 4 NIGHTS – BE THERE!

My wife Sue just went through a hip replacement last week so things have been pretty busy here as you might think. But all is well and now we begin our countdown to August.

The big news this year is phase II at the Museum and the installation of the Voice of America Transmitter. As always I wonder how we will ever get it done. With temperatures in the single digits right now, Mother Nature is not helping us. But we press on regardless.

We are actively seeking ideas on the pizza night and movie selection. We decided not to show "The Interview" for obvious reasons

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(HI HI). But seriously I would appreciate either an email (w2it@rochester.rr.com) or a phone call (585-899-6703) regarding these.

Our contest this year centers around the dual Convention Themes: *Voice of America* and *Shortwave Listening*. PLEASE PLEASE feel free to query us on these. Interesting shortwave radios are going to be the prize winners. What would you have used in an Iron Curtain Country to listen to VOA or RFE?

Bart Lee is back with us this year, after a one year hiatus, with some spectacular offerings and Tom Perera again heads up the Key and Telegraph Seminar. Mike Adams will again be here from California. We also will be having Mike Rink who will discuss the moral requirements of operating a large metropolitan amateur 2-meter repeater. Sue Copenhagen, K2SCW (my wife) will be discussing electrical safety and first aid for electrical injuries. Marc Ellis will be back with his "Moonlight Restoration" seminar.

As usual we charge a single flat fee for as many flea market spaces as you need—first come first served and with common sense rules regarding participation.

Roy L. Wildermuth, III W2IT
Chairman, 2015 AWA World Convention

Summary of Minutes

AWA MEMBERSHIP MEETING, 2014

The meeting was called to order by Deputy Director Robert Hobday at 12:46 p.m. on November 2, 2014, in the Conference Center of the AWA Museum Complex in Bloomfield, NY. Present were fifteen officers and trustees including one by conference connection. One AWA member was in attendance.

By proxy vote the membership approved the re-election of trustees Lynn Bisha, Geoffrey Bourne, Thomas Ely, Robert Hobday, James Peterson, Jr., and Bruce Roloson to a term to expire in 2017. From a total of 343 proxy ballots returned and counted, 339 voted for, none against and four abstained. No nominations were presented from the floor. A motion to accept the proxy vote was passed unanimously. The minutes of the November 3, 2013 Membership Meeting were approved as read.

Deputy Director Hobday submitted the Financial Report. The Association had an extremely active year, which contributed to several expenses, many of them non-recurring. Any recurring losses must be looked at for future planning. The new Conference Center required new service installations, including a gas main, security and cameras for it and the Museum.

Other expenses included ditching adjacent to the parking lot, shelving and Plexiglas for the Museum. Some of this can be listed in future as development fund outlays. In addition, costs incurred from winter weather increased by 50% from the norm.

When all 2014 Convention costs are paid, the event will have paid for itself. Year-to-year income to the organization will increasingly come from regular Museum attendances and tourism. A new local insurance provider will be sought through a Rochester-area broker. At present, the combined value of the AWA is approximately 6 million dollars.

Roy Wildermuth noted that accounting for a non-profit organization is one of the most difficult to conduct. Richard Neidich (Membership Services) noted that income from membership dues pays mostly for publications, and costs relating to other expenses are within 5% for the last five years.

Richard Neidich presented the Membership Committee Report. The organization lost about 250 members but also added 100 members. Membership size is an indicator for the future. Membership is not an indication of revenues but rather of the relative health of the organization.

Convention costs were held low by the use of web-based registration (i.e., self-registration), simplified registration accounting and use of new software. The AWA website will soon go into Phase II and be more user-friendly. The Committee will support Museum visitation activities.

Hobday reported that after many years of service, Tom Ely and Ed Gable have announced they will soon retire from their dues and recording functions on the Membership

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Committee. Gable will also step down as Assistant Registrar.

Director Tom Peterson, Jr., reviewed the past year, noting that the amount of activities and growth of the organization is almost unbelievable. Said another way, things are developing by a sort of chain reaction. The level of productivity among the Volunteers has been significant. All this speaks to the health of the AWA and its broad-based reputation.

Deputy Director Bob Hobday submitted the Annual Report. The collection cannot continue to grow at its present rate. Non-essential and redundant items must be culled. Duplicate items are being sold on eBay, and an auction is also being considered, in addition to the Convention auction. A balance must be maintained between the size of the collection and its value. Sales of non-essential items in and from the Rochester region will generate more Museum awareness (David Kaiser). Charles Bliley inquired about any large donations that may be encumbered with conditions. Hobday: Donations are accepted without any such conditions.

The membership meeting adjourned at 1:45 p.m.

Respectfully submitted by

William L. Hopkins, *Secretary*

Summary of Minutes

AWA BOARD MEETING, 2014

The meeting was called to order by Deputy Director Robert Hobday at 1:55 p.m. on November 2, 2014, in the Conference Center of the AWA Museum Complex in Bloomfield, NY. Present were fifteen officers and trustees including one by conference connection. Secretary Hopkins reported the results of the 343 proxies received and accepted at the Membership Meeting, to reelect six trustee members to a term expiring in 2017.

By motion, officers were elected for 2015: Director, Thomas Peterson, Jr.; Deputy Director, Robert Hobday; Curator, Bruce Roloson; Secretary, William Hopkins; Treasurer, Stanley Avery. The Minutes of the May 3rd meeting were approved, with one minor word-form change.

Deputy Director Hobday presented the Financial Report and the Business Plan extending to Sept. 30, 2015. The capital budget reflects Phase II of the Museum construction, and sufficient funding is in place for this project.

New members and increased Museum traffic are partly linked to income. The year 2015 will provide the first full 12-month cycle for regular visits and an increase in tour groups, including school tours. This will require increased staffing. New funding should be sought from educational programs for STEM (science, technology, engineering, math). The number of regular member renewals increased slightly. The Board unanimously approved the budget and business plan for 2015.

Curator Roloson presented the Museum Report. The Max Bodmer Library in the Media Center has doubled in size to include a donation of rare books on telegraphy. A secure Rare Book section will be constructed by Jim Kreuzer. One example is the original notebook of Samuel B. Morse that describes and illustrates the design of the Baltimore-to-Washington telegraph line of 1844.

Equipment from the Morse collection has also been donated to the AWA Museum, including Alfred Vail's compass used for construction of the line. This donation also includes a complete Western Union station. Construction of the second floor storage area at the new Conference Center storage facility has been funded and will soon begin. The Collins transmitter from the VOA will be ready to display by the beginning of the 2015 Conference, beginning on August 11.

Neidich presented the Membership Committee Report. Production of the AWA *Review* will be supported by an additional person to do the layout. Concepts for the next phase of the AWA website are being developed, to include a major content upgrade.

At present, daily website inquiries rarely drop below 500. All its pages are indexed for maximum exposure. The *Gateway* continues to draw interest. New personnel are being sought to fill positions of Assistant Registrar and Assistant in Membership Services, to replace Ed Gable and Dr. Tom Ely. Activities in 2015 will focus on improvements, such as

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email efforts, which require little cash outlay.

Ron Roach (Operations) reported on final improvements to the heating systems in the Media Center. New book shelving has arrived that will double the library size to 120 linear feet. A new audio archive room has been created. The Media Center and Museum have now been upgraded with LED lighting.

Transfer of offices to the new Conference Center has been completed for: Deputy Director; Marketing; Curator and Associate Curator; Operations Manager; eBay sales office; and the Board conference room

The completed part of the Museum currently covers 4,632 sq. ft. Phase II (to include the VOA transmitter at 400 sq. ft.), will be 2,668 sq. ft., and Phase III, at 2697 sq. ft., will house the theater, etc., Phase II construction will involve a 15-step sequence, and a general contractor has been identified.

New construction of the 800 sq. ft. Amateur Radio station is in preparation. At present, the AWA Complex comprises four buildings on four and one half acres, totaling 23,300 square feet of floor space. This compares with 6,600 square feet of floor space just five years ago. In all, AWA artifact holdings take up 90,000 cubic feet. Finally, an extensive list of Museum outreach activities is planned for 2015, to include one at the George Eastman House's Dryden Theatre.

Hobday presented the Administration Report. Video shooting at the Delano California site of the VOA has been completed for the upcoming Art Collins Legacy video. It is hoped that some important VOA archives from Washington, D.C., will soon be housed at the AWA Museum. A new AWA color logo was adopted, which includes essential information on its circular border. In discussion, the Board voted to accept "Antique Wireless Press" as the name for the new publication arm.

The Board meeting adjourned at 3:45 p.m.

Respectfully submitted by

William L. Hopkins, *Secretary*

WITH THE CHAPTERS

The next thing on our calendar will be our annual conference, *Antique Radio Charlotte*. I've lost count, this is either 20 or 21 years we've been at the Sheraton Charlotte Airport Hotel, which I understand will have all newly remodeled sleeping rooms by the time of our event. It will take place on March 26-27-28, Thursday, Friday and Saturday.

This year we will again have an estate collection to sell. Long-time member Steve Smith, who lived in Wingate, NC, passed away last spring just shortly after the 2014 March Meet. He was unable to attend it, since he was already in the hospital. His widow Kay contacted me a couple of months ago asking us to help her sell Steve's radios. There are about 120 pieces in the collection, mostly 20s sets with a few into the 30s and 40s. As you read this, Robert Lozier and I may have completed cataloguing and photographing the collection and putting the photos up on a web page.

The programs for the conference are almost set. We'll be having a TCA supported Tube Collectors meeting on Thursday morning. Our friend John Dilks will be giving, it looks like, two presentations. One will take place on Thursday afternoon; the other as he hosts a movie on Thursday evening. Mark Oppat is going to give a talk on restoration and repair, and we're thinking about a restoration/preservation Q&A session. There may be something else that I just can't remember right now (It's a bitch to get old).

Speaking of my getting old, board member Chip McFalls will be my co-chairman for the conference and will be managing it during the event. It's gotten so that it's almost more than I can handle anymore. I've been doing this for more than 30 years now. The conference web page is being worked on now. You can visit it via the club's main web page at http://www.cc-awa.org/

I hope everyone has a happy new year. We look forward to seeing everyone in March at Charlotte.

73, RON w4ron

http://radioheaven.homestead.com/menu.html

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AT THE MUSEUM

Visit us on the Internet at http://www.antiquewireless.org

MUSEUM MANAGEMENT AND STAFF

Thomas Peterson, Jr.
Director

Robert Hobday, N2EVG
Deputy Director

Bruce Roloson, W2BDR
Curator
Accesion Committee Chairman

Ronald Roach, W2FUI
Operations Manager

Lynn Bisha, W2BSN
Associate Curator
Registrar

Felicia Kreuzer, KA2GXL
Assistant Curator

James Kreuzer, N2GHD
Assistant Curator
Media Librarian

Roy Wildermuth, W2IT
Assistant Curator

Ed Gable, K2MP
Curator Emeritus
Historian
Assistant Registrar

Stan Avery, WM3D
Treasurer
Museum Store Manager

MUSEUM CONTACT

For all inquiries about the Museum and its operation, contact Museum Curator Bruce D. Roloson, W2BDR, Curator, P.O. Box 478, 2 Walnut Place, Apalachin NY 13732, e-mail broloson@stny.rr.com. *The A.W.A. Electronic Communication Museum is an IRS 501(c)3 charitable organization.*

From Bruce D Roloson, W2BDR, Curator, AWA Museum

This year the order of priority for our activities will begin with the movement of the Voice of America control console and major transmitter components from the Conference Storage Building to the back of the Museum. This has required the installation of large doors in the back of the Museum Building—now completed. Once the VOA components are moved, the second floor in the Conference Center Storage Building will be installed. When that additional storage space is available, the Staff will clear the back of the Museum building to allow for construction of Phase II.

Additional shelving units have been installed in the AWA Media Center, doubling the space available for our growing book collection. This will complete our library facility. The new shelves were purchased thanks to a generous donation from one of our members.

We have just received a large collection of Telegraph and Teletype equipment, which was quickly cataloged, photographed and data based. The collection was a donation from Steve Wolf and his family. It was made up of Stu Davis's National Telegraph Museum, items from the Western Union Museum, and items collected by Steve's father Sherman Wolf.

This collection will be one of the new major displays in Phase 2. Among the items included are Samuel F. B. Morse's notebook with drawings of the Washington to Baltimore Telegraph line (on loan), a reproduction register as used by Morse on the same line, and a compass used by Alfred Vail during the construction of that line (on loan). We will have photographs of some the items from the collection in the next *Journal*.

The theme of the 2015 Convention will be "International Short Wave Broadcasts Stations and the Radios That Listened to Them". It would include VOA (Voice of America), BBC and any other short wave stations as well as the radios, manufactured or homemade, that people used to listen in.

Remember the Conference is the same week as last year; beginning Tuesday, August 11th, 2015. Also, the Museum plans a major auction of duplicate collection artifacts in conjunction with the AWA Spring Meet on Saturday afternoon, May 2nd, in Bloomfield. Please visit the AWA website for further information about the auction. We will post it as it becomes available.

From Ron Roach, W2FUI, Operations Manager, AWA Museum

The anticipated annual tour and pot luck supper shared by the Squaw Island

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THE ITEM IN QUESTION

Spotlighting Noteworthy Artifacts From the Collection of The AWA Museum

BY WILLIAM HOPKINS, AA2YV • EMAIL: WHOPKIN4@NAZ.EDU

The "Printing Telegraph" Exhibit and E. E. Kleinschmidt's Inventions

Abridged from an interview with Duncan Brown, K2OEQ, e-mail duncanancy@earthlink.net

The AWA Museum collections include at least forty different models of printing telegraphs (or teletypewriters) from ten different manufacturers. Several pieces of equipment are connected to the Internet and type out the latest world news, of course all in capital letters. Visitors habitually stay longer at this exhibit, because the "old" dovetails seamlessly with the "new."

Duncan Brown (K2OEQ) is both the creator of the exhibit and its best supporter. He admits to being one of possibly six people in the U.S. who are the keepers of this technology's history, out of a much larger group of "Greenkeys" enthusiasts. The item in question represents just a few of several pieces that Duncan talked about in the much longer interview that we conducted.—William Hopkins

WH: Duncan, you frequently explain to Museum visitors the development of the printing telegraph, basing it on a timeline. You have chosen to explain several rare pieces of equipment for this interview. This Model 20A Tape Printer stands close to the beginning of the exhibit.

DB: As I explain, I would also like to highlight one of America's great inventors, Edward E. Kleinschmidt (1875-1977) and explain his importance.

WH: How did you find this piece?

DB: Before the Museum moved into its new buildings, the 20A Tape Printer was stored away in the old Museum Annex, in the back of the "Morse Code Key Room." Shortly after I retired and joined the AWA Museum, I began looking around in that room, and I found this item down on the floor. I didn't know what it was until I saw a Kleinschmidt Electric Company *KEC* label on it.

When most people think of mechanical writers like this, they think of "Teletype." But Teletype is a word that, like Xerox, is really a brand name and/or company name, not a generic name. When I was in the Army as a teletypewriter repairman (1966-70), most of the equipment I worked on was made, not by the Teletype Corp, but by Kleinschmidt Laboratories Inc. Before then, I had never heard of Kleinschmidt.

When I saw "Kleinschmidt" on the item I thought "Hey, this is not a Morse thing, this is something else!" So I pulled it out and dusted it off. Initially, I saw no model number or name besides the KEC label, but then I spotted this piece of tape over here. See, it says "20A printer." It looks like a regular typewriter without a keyboard, but the typebasket is mounted vertically so that it can type on a strip of paper. It turns out, after I did some research, that this unit was originally a *page* printer.

WH: Why the shift from one printing technique to another?

DB: This 20A was built for Western Union for their telegram traffic. They were having trouble on some of their lines resulting in loss of parts of the message which would have to be repeated. Since they were originally receiving a page of text and printing it directly onto a telegram form, the whole message would have to be sent over again whenever it became garbled in places.

So they said: why not do it all on just one strip of paper? We'll gum it and stick it onto the telegram form. If we lose some of

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Two views of the Kleinschmidt Electric Model 20A Tape Printer.

the message, and have to repeat part of it, we'll take the part we missed and paste it in where it should go. Also, throughput could be increased by switching to tape printers since a tape printer does not have to stop printing to return a carriage or feed the paper.

WH: How long was that procedure used?

DB: Well, starting in probably 1920 or so, that remained the standard way of doing it until they computerized in the 50s or 60s. What KEC did was to turn their page printer onto its back to become a paper strip printer, which used pre-gummed paper tape. The tape would come out on the side, where there would be a moistening sponge. The taped message would be run over the sponge for pasting onto a telegram form.

I've never been able to find out anything about this 20A tape printer—no one seems to know anything about it, including E. E. Kleinschmidt's grandson, who is an AWA member**.** This one was probably a prototype from 1920 or earlier and is probably the only one in existence. KEC also sold a 21A model and a 22A model. I think the 22A was their final version. Many companies had special designations for their Western Union models.

WH: Can this piece of equipment be made to work?

DB: It could, yes, with the right signaling going into it. We would probably have to oil it a little bit. Other machines here are already hooked up to work from the Internet. The 20A operates with solenoids only, no motor. It uses the standard 5-bit pattern and there is one solenoid or "selector magnet" for each bit. The 5 bits representing a letter are sent to the 5 selector magnets and latched (stored) in position until a "print" command is received to energize another solenoid which pulls down the selected type arm to print the letter onto the tape. You can see the "RY"s printed on this tape. I printed these letters by holding down the right selector magnets and then pushing down on the print solenoid. All the early 5-bit printing telegraph equipment operated in a parallel (rather than serial) mode.

This parallel operation is similar to the system that's used in today's microprocessors. All the data sent around inside your computer is sent along parallel lines, while an address line feeds into each chip to latch the data into the chip. In this way, the architecture of today's computers is based on equipment designed 100 years ago.

From 1875 until about 1925, 5-bit printing telegraph equipment was all operated in parallel, but the messages were transmitted serially. Mechanical parallel-to-serial and serial-to-parallel converters called "distributors"—which looked like the old automotive engine spark distributors—were used at each end of the circuit. This allowed time division multiplexing of up to four circuits on one pair of wires and provided synchronization.

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Let me explain a bit more about the encoding. The inventor of the 5-bit code was a Frenchman named Emilie Baudot (1845-1903), but he did not use perforated tape. It was about 1875 or so. His system transmitted from a 5-key piano-style keyboard that was operated with both hands. This keyboard (in parallel) fed a distributor that put the signal out onto the serial line, multiplexing it with others.

The operator had to know the 5-bit code and hold down the keys at the right time, when told to by the distributor. This 5-bit code was different from the one we are familiar with, as it was designed for ease of learning and included French characters. From his name we get the term "baud" meaning modulation rate.

Donald Murray (1865-1945) of New Zealand was the first to use the 5-bit perforated tape. In 1890-1900, he perfected the 5-bit Baudot code and added "carriage return" and "line feed" functions. He also developed and patented a keyboard tape "perforator" and a "reperforator" (receiving perforator).

His system used the same multiplex design that Baudot used, but a tape was perforated by a keyboard-operated machine similar to this Teletype Corp.'s GPE perforator on the shelf next to the 20A. After being punched by the keyboard perforator, the tape was fed into a tape reader that read the punched holes in parallel and sent them to the multiplex distributor. At the receiving end, the message was routed to either a page printer or a reperforator. The tape from the reperforator could be used to resend the message to another point in relay fashion.

I should add here that the two major companies producing printing telegraphs in the US in the first quarter of the 20th century were the Kleinschmidt Electric Co. and the Morkrum Company. Morkrum ownership was shared by Charles Krum and the Morton family (the salt people). Between 1900 and 1910, Charles Krum developed the start-stop 5-bit code that later became the standard.

One of the problems with the older Baudot & Murray multiplex systems was the difficulty in keeping all motors in the system synchronized to the same speed. Ultimately, the start-stop system solved the synchronization problems, since individual unit motor speed was not as critical.

WH: Could you explain a bit more about the start-stop system?

DB: Remember, the 20A tape printer operated in a synchronous system, which didn't need the start and stop bits. If you just send out a stream of serial bits, how do you know to group them into separate characters? Charles Krum added a "Start" bit and a "Stop" bit to Murray's 5-bit code. A start-stop teletypewriter normally has loop current flowing during its rest mode. When a character is sent (from either a keyboard or a tape), the loop current drops to zero.

This is the start bit which is always zero ("space") and it tells the printer to get ready to read the next 5-bits for the next character. Once the 5 bits are sent, the loop current returns to its nominal level (i.e., "mark") and puts the printer back into rest mode. So the keyboard (or tape) transmitter synchronizes the receiving printer on every character.

By 1924, both KEC and Morkrum Co. were having financial problems. Customers were pairing one off against the other, and no customer had enough faith in the small companies to place a large order. Morkrum sued KEC for patent infringement, and KEC counter-sued. However, they realized that a big court case would probably kill both companies, so they solved it in December of 1924, by simply joining the two companies into the Morkrum-Kleinschmidt Corporation.

Now, before Morkrum and Kleinschmidt joined forces, Morkrum was using "Teletype" as a brand name, but it wasn't the name of the company. On the wall here is a 1928 Morkrum-Kleinschmidt advertisement, indicating they were using the Teletype brand name. The next year, in 1929, they dropped the cumbersome "Morkrum-Kleinschmidt" name and renamed the company the "Teletype Corporation." Soon afterward, AT&T bought the Teletype Corp. and made it part of Western Electric. There's a lot more to the printing telegraph story, but this is a good start.

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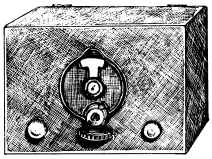
AMATEUR RADIO



EDITED BY **TIM WALKER, W1GIG**, 19 WOODSIDE AVE., WESTPORT, CT 06880, W1GIG@ATT.NET, *PLEASE INCLUDE SASE FOR REPLY.*

AM QSO Party and John Rollins Memorial DX Contest

Greetings:

I will have to admit that it is a bit disturbing to be writing this, and at the same time waking up and trying out my two classic 1929 transmitters for the Bruce Kelley Memorial QSO Party. Here it is the day after Thanksgiving and you won't see this till February when it is time to gear up for our AM QSO Party.

(Editor's note: regretfully, you probably won't be seeing this until after the AM party. The holidays plus a couple of bouts with the flu at my house have seriously slowed Journal *production. Happily, the information is already up on our website and I am also forwarding copies of this manuscript to Tim Walker and Lynn Bisha. Hopefully they, in turn will send copies to the relatively few participants who don't have Internet access.—mfe)*

Speaking of which, here we go. The party will be on Saturday, February 7 at 2300 GMT until Sunday, February 8th. Twenty four hours to warm up the bands with real signals. Unfortunately W2AN, the big Millen transmitter, is still packed away in the storage building waiting for space in the Museum itself. We have twisted arms and have several volunteers that will fill in from their own home stations. They will do their best to answer all calls that they hear. Further, the James Millen Society will have W1HRX on the air in a similar fashion. Look for them as the first contact with each is worth 10 points.

Following closely in March we will sponsor the John Rollins Memorial DX contest which is for relatively modern gear. The dates are March 4 &5 and 7 & 8. We do our best to avoid MAJOR MAJOR contests, but in the winter months there are so many that we try to pick the quietest weekends. That is also the reason why we do Wednesday night and Thursday to give us a chance between the weekends. So, let's use it! Detailed information packages on both events follow.

As we are here for you, if you would like to put in your nickel's worth please feel free to make any comments, or suggestions that you may have on the content or operation of our events and we'll discuss them in the Amateur Hour at the convention in August.

73, Tim

2015 AWA AM QSO Party

Where did 2014 go? It is already time to tune up and check out those rigs for the famous AWA AM QSO Party. We have chosen February 7 & 8, 2015, to once again heat up the aether in an attempt to make ourselves heard over the other contesters that weekend. The rules remain the same as previous years, and, as usual, extra points will be granted for our 2 flagship stations. (W2AN & W1HRX) The flagship stations will not be on the air for the entire event but will appear on most bands at various times.

The frequencies given here are only for meeting others, please QSY a bit to keep the ball rolling. If you are rock bound, don't give up, we will find you. Let's show the amateur community that AM is alive and well. This is the best chance of the year to hear a wide variety of vintage gear and to talk to some of the friendliest people on the air.

Dates and Times: Sat. Feb. 7 @ 2300 GMT to Sun. Feb. 8 @ 2300 GMT

Objective: To promote and encourage the use of AM as a mode of operation in ham radio, and, above all, to have fun.

Frequencies: around 1.925, 3.835 – 3.890, 7.280 – 7.295, 14.275 – 14.295

Exchange: Name, state, (province, or country. That keeps the log simple, but don't be afraid to talk about your station, or to ask about another station. This contest is about fun, above all. Nobody cares about

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your QSO rate!

Scoring and Classes: For stations running 100 watts or less carrier OUTPUT, each contact counts as 2 points. Stations running more than 100 watts count as 1 point. All 20 meter contacts count 5 points regardless of power output. You may contact each station only once per band. See extra points for the Flagship stations below.

Flagship Stations: There will be two authorized flagship stations participating in the AM QSO Party. These stations will not be included in the final points standings. Their scores will be listed separately in the results. W2AN is the AWA Museum and this call will be used by various volunteer stations in the contest. The other call sign W1HRX will be operating courtesy of the James Millen society. The first contact with a flagship station counts 10 points, all subsequent contacts are 1 point.

Logs: There will be a summary log sheet posted on the AWA web site. It is not necessary to send your entire log, only the summary sheet is necessary. Even if you only make a few contacts, please send in a log sheet so you can be counted as a participant. For those without web access, send a #10 SASE to the address below and we will mail you a copy. E-mail and paper logs must be postmarked no later than March 10th and sent to one of the following addresses: lbisha@rochester.rr.com or Lynn Bisha, 83 Parkwood Lane, Penfield NY 14526.

Results: Results will be published in *The AWA Journal* as well as *Electric Radio* and also online at *Amfone.net*.

2015 John Rollins Memorial DX Contest

Dates: Wed. Mar. 4 @ 2300 GMT to Thu. Mar. 5 @ 2300 GMT; Sat. Mar. 7 @ 2300 GMT to Sun. Mar. 8 @ 2300 GMT

Bands: 40 and 20 Meters Try 7.100 and 14.045.

Exchange: RST, Name, State, Year of TX and RX and power input. For homebrew equipment use the year you built it or designed it.

Special Conditions: This is a CW contest designed to favor those using transmitters and receivers constructed before 1960 and straight keys. All equipment vintages are welcome, even modern solid state rigs. The contest is open to everyone. Non-AWA operators are especially encouraged to participate and have fun. Those using under 25 watts input and older gear get higher scorers. Those that feel they may have a high score, should send in full details on equipment and station photos.

A sample log sheet is available on the web site and logs are due four weeks after the contest. Logs can be submitted by email to W1ZB@ARRL.net or by U.S. mail to Jerry Reine, 5 Tobey Lane, Andover, MA 01810.

Good Luck! Jerry, W1ZB

AUTHORS, *continued from page 4*

came responsible for the installation and operation of ground-test instrumentation in support of new aircraft development tests for the Air Force and the Navy. Later this included early development testing for the Atlas ICBM program.

Kinzie continued at Convair until 1962, and then moved to Rocketdyne's Research Department near Los Angeles. Development of the large liquid propellant rocket engines for the Apollo Project was well under way at that time, and he developed sensors and calibration equipment for measuring the high temperature and heat flow conditions produced in the engines. This effort continued until after the first lunar landing in 1969.

During the 1970s, Kinzie was employed at two other engineering companies and wrote a book on thermocouples for temperature measurement (published by John Wiley & Sons in 1973). After 1980, he worked in a non-technical field that that gave him more time for crystal radio experiments and his studies of early radio history.

He is a long-time member of AWA and a life member of the Arizona Antique Radio Club. He has written for the Arizona Club's Newsletter as well as the Xtal Set Society.

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BOOKS AND LITERATURE

ERIC WENAAS, P.O. BOX 676028, 14813 RANCHO VALENCIA VISTA, RANCHO SANTA FE, CA 92067, E-MAIL: ERIC@CHEZWENAAS.COM

Books to be reviewed in this column should be sent directly to Eric Wenaas at the address above. After review, all such books become a permanent part of The AWA Library, which is available to members for browsing and research.

DecoRadio: The Most Beautiful Radios Ever *Made* *by Peter Sheridan. Published by Schiffer Publishing, Ltd. Pages: 352; 12" × 9"; 380 photos. Hardcover $79.99*

Peter Sheridan's book *DecoRadio*, which contains 380 photos billed as the most beautiful radios ever made, is certainly a leading candidate for the most beautiful book on radios ever published. He says his selection criteria are based on the cabinet and how it fits into the Art Deco genre. Criteria include cabinet shape, size, texture, variety and color—and of course overall design aesthetic.

The focus of the book is clearly on Bakelite and Catalin radios, but certainly not to the exclusion of other materials such as wood, metal and glass. According to the author, the vast majority are mantle (table top) radios because, from 1930, this is the novel form that allowed designers full expression of modern streamlined styling with mass production, using new materials and an array of colors. Although most of the radios in the book were manufactured in the 1930s and 1940s, the book covers radios from the 1920s through the 1950s. A few loudspeakers and phonographs are also included.

Sheridan says he has 300 radios in his collections, and while he is from Australia, his collection has a global reach with 25% being from Australia, 40% from the U.S., and the remainder from the UK, Germany, France, Spain, Italy, Holland, Belgium, Canada, Czechoslovakia, New Zealand, Denmark, Mexico and Russia. There are something like 340 radios pictured in the galleries, all of which but five were photographed by the author himself.

He actually traveled around the world visiting 24 other collectors in a number of different countries to capture images of Art Deco radios not in his personal collection. Sheridan says that the radios appearing in the book are a personal choice—those that he thought would give the reader "a chance to sample the best the world produced during that short twenty-five year period of the 1930s to the early 1950s."

The book is divided into two parts, the first part consisting of fifteen chapters packed with all sorts of interesting information on Art Deco radios ranging from descriptions of the criteria used to select the sets to more esoteric topics such as a discussion of the resins used to make the sets and the fine points of knob and escutcheon design. The second part, comprising approximately 70% of the book, is a series of picture galleries arranged chronologically by decade with color photographs of the highest quality interspersed with ads including photographs of selected sets provided by the manufacturers.

There is a wealth of information in the first part of the book helping to explain and interpret both the Art Deco movement in general and the design features of the Art Deco radios appearing in the gallery. For example, Sheridan identifies the common elements in Art Deco radios that he says reflect the ethos of streamlining and deco design elements: use of new materials, mass production, inexpensive designs, use of parallel lines/circles/squares, use of bright colors, a minimum of ornamentation, and a futuristic design.

He describes the role of the designers of Art Deco radios, identifies many of the well-known designers, and gives examples of the radios designed by selected individuals. Included is one of the best descrip-

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tions of the plastics used in deco radios that I can recall. The two main types of plastics are described: their characteristics and the development of specific brands such as Bakelite and Catalin. There is so much more information in the first part of the book that I cannot possibly do it justice here. Be sure to read the first eighty-five pages of introductory material before studying the galleries that follow.

Speaking of galleries, Sheridan has evolved a style that reaches its pinnacle in this book. The page introducing the Radio Gallery consists of a poster-like image containing thumbnail photos of most of the models in the book, although not all the colors of each model are included. The author says that there was some intent to indicate size in this figure, but there is no real accuracy.

The smaller radios are placed at the top of the page while the larger radios are at the bottom—but, of necessity, they are not to scale. The main gallery that follows is divided into four parts, one for each decade from the 1920s through the 1950s. Preceding each "decade gallery" is a thumbnail gallery containing photographs of each model type for that decade. These thumbnail photos are shown to scale and arranged by country and in the chronological order as they appear in each respective decade gallery.

Each decade gallery contains all models with various color schemes, supplemented by contemporaneous photographs and ads that chronicle selected sets. The photographs of the radios, which are generally arranged one to a page in high resolution, are truly breathtaking—although some radios share a page with an advertisement, an historical photograph picturing the set, or several photographs of the same model but with different color combinations.

The degree of color variations between and among the various models is particularly striking. The entire book including the photograph galleries is arranged on pages with a rich glossy black background that gives an elegant appearance to the radios—particularly those in the red, yellow, white, blue, beige and rich wood tones. Unfortunately, the black background does not work well for radios with the darker tones.

Some of the black radios blend into the black background such that certain portions of the radios cannot be distinguished. Nevertheless, Peter Sheridan is to be commended for his selection of sets, for the wonderful photography and for the excellent layout of the book.

The author says he began collecting radio with a focus on Australian manufacturers in 1997 and amassed a collection of 120 sets by 2007. At that time he wrote a book entitled *Radio Days: Australian Bakelite Radios*, which was co-authored by Ritchie Singer and published in 2008. *Radio Days* is a photographic history of Australian Bakelite radios from the 1930s to the 1950s. Since 2007, Sheridan changed his focus and collected another 180 sets involving a wide-ranging search for the best of the Art Deco style radios in the world, particularly those with a heritage from known designers and with vibrant colors. *DecoRadio*, which includes only 19 of the radios appearing in *Radio Days*, chronicles the results of his more inclusive collecting interests over the past seven years.

I highly recommend this book, particularly if you like Bakelite and Catalan radios from the Art Deco era. If you decide to purchase this book and search for it on the Internet, it is worth noting that the publisher has chosen to market this book under the title *Deco Radio* (with a space between Deco and Radio) even though it was printed with the title *DecoRadio,* which appears on the cover and throughout the text of the book. Many of the Internet sites selling this book, including that of the publisher, will not return a query with the *DecoRadio* spelling at this time.

Heathkit Equipment Products

By Chuck Penson. Published by Chuck Penson. Pages: 196; 8½" × 11". Paperback $19.95

Author Chuck Penson has captured the essence of Heathkit with his second book chronicling products made by this company. Whereas his first book, entitled *Heathkit: A Guide to the Radio Amateur Products,* published in 2003, focused on amateur radio,

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this book focuses on test equipment sold in kit form. The author says that to the best of his knowledge, the book lists 100% of the kit-form test equipment products sold with nothing of significance omitted.

After a very interesting introduction summarizing the history of the company and the organization of the book, he presents twenty-two chapters, one for each product type. The models in each category are presented in alphanumeric order accompanied by high-quality black and white photographs of each. The photographs could have been larger, but still they are quite sharp and convey significant detail.

Each kit is accompanied by a single paragraph describing the essential details. Since the models in each chapter are presented in alphanumeric order according to model number rather than chronologically, the author has included references to the models that precede and follow each entry, which he says will facilitate chronological explorations.

There are three convenient indices at the end, listing products according to model number arranged in alphanumeric order, product type arranged in alphabetical order, and chronologically by date of introduction. Penson has used a chapter-page numbering system for each of the 22 chapters and three indices such that each chapter and index begins with page 1 (e.g., 1-01). The book is clearly meant to be a reference book for Heathkit test equipment kits, and its clarity, excellent organization and completeness will assure that it will become a classic reference book.

Chuck Penson, being a historian for the Titan Missile Museum south of Tucson, AZ has a perfect background for researching and writing this book. He says that he has been studying the Heath company and collecting Heathkits since 1980, giving him 34 years of hands-on experience. It should be noted that he is also a ham radio operator with license WA7ZZE. According to the copyright page, the book can be ordered directly from the author at wa7zze@gmail.com, but it also available from other dealers such as Antique Radio Classified and Amazon.com.

AUTHORS, *continued from page 16*

The latter organization published his book *Crystal Radio: History, Fundamentals, and Design* in 1996.

ERIC P. WENAAS

What's "de" Story on the Spelling of Lee De Forest? Part I: De Forest's Autobiographical Account

Eric Wenaas has had a lifelong passion for antique radios, beginning with his first Radiola and crystal set given to him by family friends as a young man growing up in Chicago. He experimented with radio devices and repaired radios and televisions as a hobby while in high school. He then studied electrical engineering at Purdue University, graduating with B.S. and M.S. degrees. Wenaas went on to the State University of New York (SUNY) at Buffalo where he earned a Ph.D. degree in Interdisciplinary Studies in the School of Engineering. After graduating, he spent most of his career at Jaycor, a defense company in Southern California—first as an engineer and later as the President and Chief Executive Officer.

Upon his retirement in 2002, he set out to research the early days of wireless and document interesting historical vignettes based on original materials of the era. He has written numerous articles for the *AWA Review,* the *AWA Journal* and *Antique Radio Classified. In* 2007, he published the critically acclaimed book *Radiola: The Golden Age of RCA—1919-1929.* It covered the early history of RCA and included the formative years of the Marconi Telegraph Company of America. For this work, he received the AWA Houck Award for Documentation in 2007. He is a lifetime member of the AWA and a past member of both the IEEE and the American Physical Society. Dr. Wenaas resides in Southern California and continues to enjoy collecting radios, researching the early days of wireless and writing articles.

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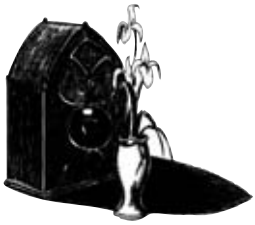
RECENT RADIO, TV AND ENTERTAINER OBITUARIES



COMPILED BY **CHARLES S. GRIFFEN, W1GYR**
400 SEABURY DR., APT. 4153, BLOOMFIELD, CT 06002-2660

Note: When known, the date of death is indicated in parenthesis.

LAUREN BACALL, 89, (8-12-14) actress. Bacall's first film was *To Have and Have Not* opposite Humphrey Bogart in 1944. The smoky-voiced, green eyed star appeared with him in *The Big Sleep* (1946), *Dark Passage* (1947) and *Key Largo* (1948). Born Betty Joan Perske, she also co-starred with many other artists, including Kirk Douglas, Gary Cooper, Marilyn Monroe, John Wayne and Gregory Peck. In 2009 Bacall received an Academy Honorary Award in Recognition of Her Central Place in the Golden Age of Motion Pictures. On Broadway she starred in *Goodbye Charlie* (1959), *Cactus Flower* (1965) and *Applause* (1970) which earned her a Tony Award. She and Bogart starred in the syndicated radio show *Bold Adventure* (1951-1952). Bacall was a New York stage actress and model in *Harper's Bazaar* when she came to the attention of director Howard Hawks. He placed her under contract and cast her opposite Bogart. She studied at the American Academy of Dramatic Arts in New York City. Bacall married Bogart in 1945 and they became one of Hollywood's legendary couples onscreen and off. He died in 1957.

ALFRED "BRUCE" BUCHANAN, 90, (8-21-14) executive. Buchanan was Vice President of Radio for Multimedia, Inc. where he managed WFBC (AM & FM) in Greenville, SC and supervised twelve other stations throughout the south and Midwest. In addition, Buchanan was Executive Producer of the Clemson Radio Sports Network and served on the advisory boards for the Associated Press, National Broadcasting Company and the National Association of Broadcasters. During WWII he served in the U.S. Navy. Upon discharge Buchanan returned to Chicago to complete his education and begin his career in broadcasting. His original goal was to become a radio sports announcer. Instead, the majority of his career was spent in management in Greenville. Buchanan served as President or Chairman of the Greenville Downtown Lyons Club, the Greenville YMCA, the Greenville United Way, the Greenville Jaycees Civic Affairs Committee and other organizations.

ANN B. DAVIS, 88, (6-1-14) actress. Davis is best remembered for her role as Alice Nelson, the wise cracking live-in maid, on *The Brady Bunch* (ABC 1969-1974), *The Brady Bunch Hour* (ABC 1977) and *The Bradys* (CBS 1990). Reruns of *The Brady Bunch* aired from July 1973 to August 1975. She also played Charmaine "Schultzy" Schultz on *The Bob Cummings Show* (NBC 1955, CBS 1955-1957, NBC 1957-1959) and received Emmy Awards for her performances in 1958 and 1959. She was a cast member on *The Keefe Brasselle Show* (CBS 1963), *The John Forsythe Show* (NBC 1965-1966) and made guest appearances on such shows as *Wagon Train* (1960), *The Love Boat* (1980) and *Hi Honey, I'm Home* (1991). Some of her film credits included *Pepe* (1960), *Lover Come Back* (1961) and *The Brady Bunch Movie* (1995). Davis graduated from college in 1948 and performed in night clubs and stage productions before moving to Los Angeles. Her big break was landing a part on *The Bob Cummings Show*.

JAMES GARNER, 86, (7-19-14) actor. Garner will be remembered for his role as Jim Rockford on *The Rockford Files*, a detective drama, seen on NBC Television from 1974 until 1980. He earned an Emmy Award for his work on the show in 1977. He also starred as Bret Maverick on *Maverick*, a western, on ABC Television from 1957 to 1962. Some of his other cast credits include:

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The Next Step Beyond (NBC 1971-1972), *Bret Maverick* (NBC 1981-1990), *Man of the People* (NBC 1991), *Chicago Hope* (CBS 2000), *First Monday* (CBS 2002) and *8 Simple Rules for Dating My Teenage Daughter* (ABC 2003-2005). Garner was featured in over 50 films including — *The Great Escape* (1963), *The Americanization of Emily* (1964), *Victor/Victoria* (1982) and *Murphy's Romance* (1985) co-starring Sally Field. He served in the U.S. Army during the Korean War and upon discharge began his acting career. Born James Scott Baumgarner, Garner earned small parts in television and movies. He won a lead role in the film *Darby's Rangers* in 1958.

DR. KARL GERHARD HERNQVIST, 92, (7-7-14) physicist. Dr. Hernqvist joined the RCA Laboratories in Princeton, NJ in 1949 where he worked on microwave tubes, electron guns, and gas-discharge devices. He became a U.S. citizen in 1952. In 1956 he developed the thermionic energy converter and four years later became involved with gas laser technology. Dr. Hernqvist was born in Sweden and worked on radar and microwave instrumentation in the Royal Swedish Air Force during 1945 and 1946. From 1946 to 1952 he was involved with electron-tube research at the Research Institute of National Defense in Stockholm. Dr. Hernqvist received five RCA Laboratories Achievement Awards and held 36 issued patents. In 1970 he received the Fellow designation at RCA Laboratories and in 1980 was awarded the Outstanding Technical Achievement for his work to resolve major quality defects in RCA color picture tubes.

BEN HOBERMAN, 91, (5-3-14) executive. Hoberman was named General Manager of KABC (AM) in Los Angeles in 1960 where he is credited with launching talk-radio. It became the first full-time, talk radio station in a large market, backed by a major company. He wanted the station to stand out and appeal to a well educated and affluent audience. Hoberman remained there until 1979 when he was named President of the ABC Radio Division in New York City where he supervised six satellite networks, six AM and six FM stations and syndicated programs. He held the position until 1986 when Capital Cities Communications bought the company. Hoberamn got his first radio job at WMFG (AM) in Hibbing, MN when he was 18. During WWII he was assigned to the Armed Forces Network. Upon discharge in 1946 he joined WELI (AM) in New Haven, CT. In 1950 Hoberman moved to ABC-owned WXYZ (AM) in Detroit, then became General Manager of WABC (AM) in New York City in 1958. Before relocating to Los Angeles Hoberman was named to the Broadcasting and Cable Hall of Fame in 2003.

HERB JEFFRIES, 5-25-14, (100) singer and actor. Jeffries was a jazz balladeer who gained fame in the late 1930s as the "Bronze Buckaroo," the first singing star of all-Negro cowboy films. Some of his film credits: *Harlem on the Prairie*, *Rhythm Rodeo*, *Two-Gun Man from Harlem* and *The Bronze Buckaroo.* In 1933 he joined Earl "Fatha" Hines Orchestra at the Chicago World's Fair and spent two years on tour with them. By 1940 he was singing with Duke Ellington Orchestra and had a record hit in 1941 singing *Flamingo.* It sold over 14 million copies. (His name had been Herbert Jeffrey, but the credits on the record mistakenly called him Jeffries, so he renamed himself to match the typo.) After serving in the U.S. Army during WWII he lived in France and operated supper clubs in Paris and on the Riviera. He returned to Los Angeles in the early 1960s where he sang in night clubs, theaters, and cruise ships. Jeffries appeared on television - *Hawaii Five-O* and in westerns such as *The Virginian*. He also had a supporting role in the western film *Portrait of a Hitman* (1977). In 2004 Jeffries was inducted into the Oklahoma-based Hall of Great Western Performers.

EDWARD M. JOYCE, 81, (8-2-14) executive. Joyce was President of CBS News from 1983 until 1986. He was named Executive Vice President of the division in 1981. His management skills were challenged by in fighting, staff layoffs, threats to take over CBS by outsiders and a libel suit against

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CBS News for $120 million. Joyce began working for CBS in Chicago in 1954 followed by their Los Angeles affiliate. He joined WCBS (AM) in New York City in 1959 and hosted jazz programs and *The Talk of New York.* Joyce was named News Director of WCBS in the 1960s and helped create the station's all-news format, *Newsradio 88.* He later held top posts at CBS TV stations in New York, Chicago and Los Angeles before returning to New York City in 1981. Joyce dropped out of college in Wyoming to become a disc jockey at KODI (AM) in Cody, WY. In 1988 his experiences at CBS were published in *Prime Time, Bad Times*.

CASEY KASEM, 82, (6-15-14) radio personality. Kasem hosted one of radio's most popular syndicated music shows, *American Top 40.* When it began on July 4, 1970 it was heard on five radio stations but by the mid-1970s it was being carried by 1,000 outlets nationwide. The show ended in 1988 because of a contract dispute with Watermark Inc., the syndication company. Next year Kasem began *Casey's Top 40* on another network. Some ten years later he acquired the name rights to *Ameican Top 40* which he hosted until 2004. Kasem also did voice-overs for an estimated 10,000 commercials and cartoons. He provided the voice for Scooby-Doo's pal Shaggy in 1969 and did the commentary for Robin "the Boy Wonder" on the animated *Adventures of Batman* in 1968. Born Kemal Amin Kasem, he served in the U.S. Army and later worked for KRLA (AM) in Los Angeles. He was inducted into the Radio Hall of Fame in 1992 and received the Radio Icon Award at the 2003 Radio Music Awards.

JOHN MCCLURE, 84, (6-17-14) recording engineer. McClure was a record producer and recording engineer who worked in the fields of classical, jazz and popular music. After dropping out of college he learned to operate a recording console at Columbia Records in the early 1950s eventually becoming Director of Columbia Masterworks and then enjoyed a freelance career in the early 1970s. McClure engineered Bruno Walter's cycle of the nine Beethoven symphonies with the Columbia Symphony Orchestra. He also worked on over thirty recordings with Igor Stravinsky and around 200 with Leonard Bernstein. McClure also worked with the Mormon Tabernacle Choir, Dave Brubeck, Joe Williams, and Peter, Paul and Mary. He received three Grammy Awards for Best Classical Albums in 1962, 1965 and 1968. In 2014 he received the New York Choral Society's Robert De Cormier Lifetime Achievement Award.

LORIN MAAZEL, 84, (7-13-14) conductor. Maazel was the Music Director at the New York Philharmonic, the Cleveland Orchestra, the Vienna State Opera and several other international ensembles and companies. He was the brilliant and acclaimed leader of the New York Philharmonic from 2002 until 2009. During this time nine works were commissioned and premiered, including John Adam's Pulitizer Prize and Grammy Award-winning *On the Transmigration of Souls*, commemorating the victims of 9/11. Maazel began his conducting career with the Interlaken Orchestra in 1940 just before his 10th birthday. Next he conducted the Pittsburgh Symphony and in July 1941 Arturo Toscanini invited him to conduct the NBC Symphony from the Radio City Music Hall. Maazel's first music directorship was with the Deutsche Opera in West Berlin from 1965 until 1971. He accepted the directorship of the Cleveland Orchestra in 1972. When he retired from the Philharmonic in 2009 Maazel established the Castleton Festival, for classical music and opera, on the grounds of his farm in Virginia.

JOHNNY MANN, 85, (6-18-14) conductor and arranger. *The Johnny Mann Singers* were a popular group for recording sessions and television shows during the 1950s and 1960s. They won Grammy Awards for their recordings of *Great Band with Great Voices* (1962) and *Up, Up and Away* (1968). Television credits included: *The George Gobel Show* (NBC 1957-1958), *The Eddie Fisher Show* (NBC 1959), *The Danny Kaye Show* (CBS 1963-1964) and *The Johnny Mann's Stand Up*

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And Cheer (Syndicated 1971-1973). Mann also was the Musical Director of *The Joey Bishop Show* (ABC 1967-1969). After high school Mann joined the U.S. Army and played trombone in a field band. Upon discharge he began his musical career in Los Angeles. His big break came in 1956 when he became Choral Director on *The NBC Comedy Hour*. It was here he formed *The Johnny Mann Singers* and went on to record some 40 record albums and make live personal appearances.

JESS MARLOW, 84, (8-3-14) broadcast journalist. Marlow joined KNBC (TV) in Los Angeles as a reporter in 1966 and was named anchor in 1968. At one point he co-anchored the 5 p.m. news with Tom Snyder and the 11:00 p.m. news with Tom Brokaw. Brokaw called him "a first-rate journalist and a beloved figure in the newsroom." He joined KCBS (TV) in 1980 but returned to KNBC in 1986 where he remained until he retired in 1997. Marlow began his career at WHBF (TV) in Rock Island, IL in 1958 before becoming News Director for KNTV (TV) in San Jose. He left there to join KNBC. In 2001 Marlow joined Val Zavala's twice-weekly program on KCET (TV) - *Life & Times Tonight.* He left broadcasting for good in 2003 and moved to Santa Fe, NM. Marlow's awards included eight local Emmys, a lifetime achievement award from the Los Angeles Press Club and a star on the Hollywood Walk of Fame on May 14, 1999.

JENNIFER MOORE, 64, (7-25-14) broadcast journalist. Moore began her career in Detroit at NBC affiliate WDIV (TV) as Business Editor in 1979. She was one of the first women to cover business, automotive and labor news in the Detroit metropolitan area. Moore developed a strong following because she had a reputation for "getting the story right." In 2002 she left WDIV to start a media consulting firm Konrad & Moore Inc. with a longtime colleague Beth Konrad. Later she was named Broadcast and Corporate News Manager for the Ford Motor Company. Moore began her career at an Akron radio station then came to Detroit in the 1970s to join WJR (AM) where she worked until moving to WDIV. Moore was inducted into the Michigan Journalism Hall of Fame this year and her reports "Made in Japan" were honored by United Press International and the Economic News Broadcasters Association and won a Janus National Business Reporting Award.

ROSEMARY MURPHY, 89, (7-5-14) actress. Murphy, a veteran stage actress, made more than a dozen Broadway shows over some three decades. She earned Tony Award nominations for her performances in *Period of Adjustment* (1960), *Any Wednesday* (1964) and *A Delicate Balance* (1967). Other credits included *Sad Cafe'* (1963) *Ladies at the Alamo* (1977), *Coastal Disturbances* (1987) and *Waiting in the Wings* (1999). Murphy returned to *A Delicate Balance* on Broadway in 1996 as a replacement actress. Murphy made her Broadway debut in *The Tower Beyond Tragedy* (1950). She was three times nominated for Emmy Awards and won one for playing the role of Sara Delano Roosevelt on *Eleanor and Franklin* on *ABC Theatre* (1976). Other television cast credits: *Lucas Tanner* (NBC 1974-1975), *EZ Streets* (CBS 1996-1997) and several TV movies. One of her best remembered movie roles was Maude Atkinson in *To Kill a Mockingbird* (1962) starring Gregory Peck. Other film credits: *Ben* (1972), *Walking Tall* (1973), *Julia* (1977), *September* (1987), *Mighty Aphrodite* (1995) and *Synecdoche, New York* (2008).

ELAINE STRITCH, 89, (7-17-14) singer and actress. Stritch will be best remembered for her work on Broadway where she made her debut in *Loco* in 1946. She won a Tony Award for her one-woman show *Elaine Stritch at Liberty* in 2001 and received five nominations for performances in *Bus Stop* (1955), *Sail Away* (1961), *Company (*1970) and *A Delicate Balance* (1996). Stritch was inducted into the American Theater Hall of Fame in 1995. Television credits included being a cast member on *The Growing Paynes* (DUM 1948-1949), *Pantomime Quiz* (CBS 1953-1955, 1958), *My Sister Eileen* (CBS 1960-1961), *The Trails of O'Brien* (CBS 1965-1966),

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The Ellen Burstyn Show (ABC 1986-1987) and guest spots. Stritch received an Emmy Award for her appearance in the drama "Point of View" on *Law & Order* (NBC) in 1993. Her second Emmy was for her performance in *Elaine Stritch at Liberty* on HBO in 2004. Stritch trained at the Dramatic Workshop of The New School in New York City. To celebrate her theratrical longevity she used *I'm Still Here* as her signature song.

JERRY VALE, 83, (5-18-14) vocalist. Vale was known for his renditions of romantic ballads, many of them sung in Italian, during the 1950s and 1960s. His most famous hit was *You Don't Know Me* which sold over a million copies in 1956. Other selections included *Two Purple Shadows*, *Have You Looked Into Your Heart* and albums such as *Al Di La*, *Inamorata*, *Volare, Amore* and *O Sole Mio*. Vale had over 34 records on either Adult Contemporary, the Billboard Hot 100 or the Billboard 200 Album charts. Some of his television appearances included *Opera vs. Jazz* (ABC 1953), *The Steve Allen Show* (1957, 1958, 1960) and *The Tonight Show Starring Johnny Carson* (NBC 1971, 1972, 1973). Vale, born Genaro Louis Vitaliano, began his career singing in clubs during his teenage years. At a club engagement in the early 1950s he came to the attention of Guy Mitchell, who introduced him to Mitch Miller, an executive at Columbia Records. Vale's music was featured on soudtracks of movies and he was made the subject of a book *Jerry Vale: A Singer's Life* (2000) by Richard Grudens.

Information for this column was obtained from The Boston Globe, The Complete Directory of Prime Time Network and Cable TV Shows 1946 – Present (9th edition), The Greenville News, The Hartford Courant, The New Biographical Dictionary of Film, On the Air: The Encyclopedia of Old-Time Radio, The Washington Post,

www.crainsdetroit.com,
www.hollywoodreporter.com,
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www.losangeles.cbslocal.com,
www.nytimes.com,
www.j-school.jrn.msu,
www.playbill.com,
ww.variety.com,
www.wikipedia.org.

The writer wishes to express his appreciation to Gene Garrison, Ted Hannah, K3CL and Dr. A. David Wunsch for additional source material.

MUSEUM, *continued from page 11*

Amateur Radio club and hosted by the AWA fell victim to a nor'Easter that struck the area on December 11th, forcing a last-minute cancellation. The meeting has been rescheduled for the summer of 2015 and subsequent years. However, the annual meeting of the VHF Group was held at the museum in November as planned. After the meeting, the members toured the museum.

Several senior citizen groups enjoyed visiting the museum during the Autumn months and were provided with a brief orientation before their journey of discovery began.

Thanks are extended to Dan Waterstraat who installed temporary solar lighting for the attractive exterior sign in front of the Conference Center. Permanent, stronger hard-wired illumination will be installed when Spring arrives.

Dan also installed new batteries in the lift kept at the Conference Center in anticipation of its use to move artifacts to the new second floor. The floor will be installed by Chrisanntha Construction Company, which has also installed an enlarged double door entrance on the southwest side of the museum to provide access for the VOA transmitter and remote audio center components when they are moved into their final display location as part of Phase II.

Two theater groups, one staging *The Man Who Came to Dinner* and another presenting *Judgment at Nuremberg*, are using artifacts in their productions provided by the AWA from its vast resources.

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THE VACUUM TUBE

EDITED BY **LUDWELL A. SIBLEY**, 102 MCDONOUGH RD., GOLD HILL, OR 97525-9626

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The Mercury Rectifier

Ludwell Sibley
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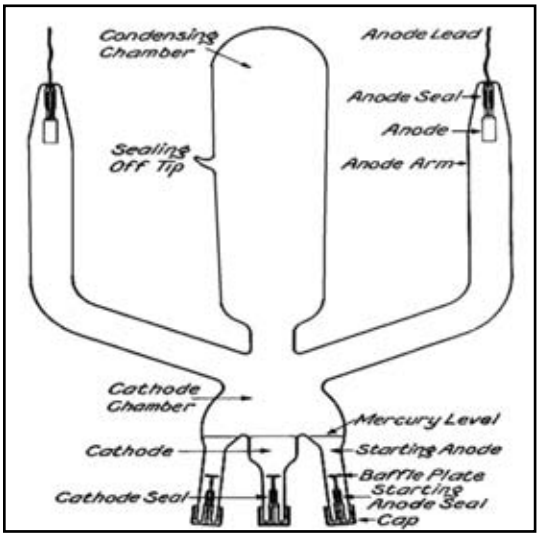
The role of rectifiers powered by mercury ions hasn't received much attention in tube history. So here's a look at a once-dominant design trend. For our purposes, the story begins with the patenting of a mercury-arc device by Peter Cooper Hewitt in 1902. This was a "pool" rectifier that operated by starting an arc within a vacuum chamber. A luminous "cathode spot" would form on the surface of the pool and the resulting ions did the rest.

As made by the Cooper Hewitt Electric Company, these devices soon seized an important place in applications at low voltage (charging batteries in electric cars and "everywhere" else, electroplating setups, movie-projector arc lights, etc.) and at high voltage (particularly in DC street-lighting systems where numerous arc lamps ran on a constant-current basis—typically at 6.6 amps, with each light dropping about 70 volts). These devices were made in sizes big enough to run railroad engines and electrochemical plants, both in glass envelopes up to about 10 inches in diameter and in steel tanks of dumpster size.

The most common of these devices was a full-wave (two-anode) configuration. However, three anodes gave three-phase half-wave operation, four took care of two-phase full-wave…up to six for three-phase full-wave. They came in a huge variety of physical forms, with anode arms pointing in all directions.

A variant on the basic rectifier formed the basis of an audio oscillator patented by Frederick K. Vreeland in 1906. This was a scaled-down two-anode unit with deflection coils added. Fed from a 110-volt DC power line, it formed a push-pull tone generator with low harmonic content at frequencies up to 2500 Hz or so. Complete oscillators were available commercially up into the 1920s, typically for laboratory use.



Schematic of a two-anode full-wave arc unit (from a GE instruction book, ca. 1916)

Mercury-arc rectifiers in the smaller sizes became displaced by hot-cathode argon-filled tubes (the GE Tungar and Westinghouse Rectigon) after World War I.

Naturally, mercury-arc technology came to the attention of radio amateurs. High voltage for the bigger tube-type transmitters was originally obtained from expensive motor-generators. A few enterprising hams found, in the mid-1920s, that an arc rectifier, typically an aged-out unit retired from street-lighting use, made a good fit for their transmitters. A 1926 article [1] promoted this application and formed a large element in the

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THERE'S THE GREATEST RECTIFIER ON THE RADIO MARKET TO-DAY- AND IF A BETTER TUBE CAN BE MADE- THEN THE NATIONAL RADIO TUBE Co. MAKES IT...
THE WORLD

Detail from a promotion for the National 6EX Tube (from QST*, date unknown).*

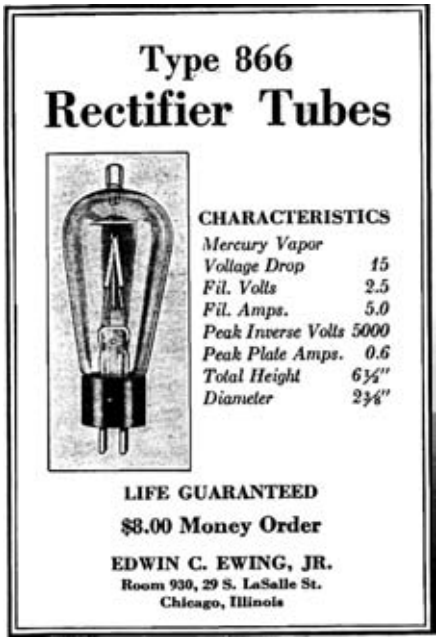
"Power Supplies" chapter in a couple of later issues of ARRL's *The Radio Amateur's Handbook*. The rectifier had a starter electrode such that tilting the tube caused the mercury to flow between it and the cathode, striking the arc. To keep some residual ionization going while the key was up, one or two "keep-alive" electrodes in the tube had to be supplied with a low voltage. The article listed several stations in the Washington, DC area, including 3CDQ (the then-famous Elizabeth Zandonini). An illustration of the transmitter at ARRL station W1AW shows one of these tubes, ca. 1930.

In the amateur field, hot-cathode (non-arc) mercury rectifiers seem to have appeared first in terms of the "6EX Rectobulb" from the National Radio Tube Company of San Francisco, "6EX" being the callsign of organizer Garrett Lewis. This item came on the market in July, 1927. A pair of 6EXs was good for an output of about 2500 volts at 500 mA, enough for the largest ham transmitters. The company made a later line of mercury half-wave rectifiers (R3, R4, R81), produced "50-watt" and similar power triodes, and a rebuilt water-cooled broadcast tubes. It was first of a line of tube companies (Lewis Electronics, Pacific Electronics, Lewis & Kaufman, then Marshall Electronics) that lasted into the 1960s.

The transmitting rectifier market broke open when RCA introduced the 866 hot-cathode half-wave tube in early 1929. With its 866A uprated version, it was a favorite up to the Age of Silicon. It led to a swarm of new makers trying to break into the marke—now-obscure brands like Gordos, Duovac, VTE Laboratories, Paramount, Thermionic Laboratories, Taylor Vacuum Products, Granger, Sal-Mar Labs (Sheldon), and Wakefield. Edwin Ewing, later the owner of Microtubes Inc., advertised an 866 in 1929.

A gaggle of other types became available: larger (869, 872) and then smaller (816). The de Forest Radio Company offered the big 575, which continued to be available from others after de Forest folded.

In the realm of larger transmitters, GE developed the 857 in time to apply it in an



Edwin Ewing offers 866 tubes (from QST*, Dec. 1929).*

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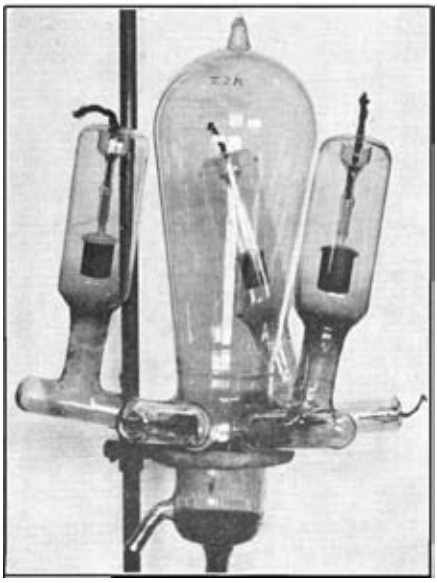

One of the rectifiers at KDKA (from Radio Engineering*, April 1931).*

RCA-branded 50-kW transmitter in the first installation at WTIC (Hartford, CT) in 1929. A sextet of these 20-inchers, or their replacement the 857B, became routine stuff in 50-kW transmitters of all makes. Western Electric had introduced its 7A 50-kW system in 1929 with water-cooled high-vacuum rectifiers, but with their large voltage drop these tubes were so wasteful of power as to be displaced soon by the 266B, "WE's 857B." As inefficient as vacuum rectifiers were, they were an improvement over motor-generators like the 4-kilovolt unit in the WE 6A one-kW set.

Arc rectifiers did not reach prominence in American broadcast transmitters, except for one known case: the "new" 1931-vintage 50-kW system of KDKA in Saxonburg, PA. Here multiple three-anode units, presumably made by Westinghouse, provided service.

The prospects for 500-kW broadcast stations in the early 1930s led GE to introduce the 870 tube, and induced Western Electric to design its 299A. The 28-inch WE tube seems to have never been made commercially, but the 870 (and its metal-cased successor the 870A) served in the Model TAW 300-kW low-frequency commercial transmitters built by GE for several Navy bases across the globe.

In the receiver/audio market, there were a few mercury contenders that had been introduuced in the 1930s. Various small makers like Johnsonburg and Perryman offered mercury-dosed versions of the common 280 high-vacuum tube. RCA, in 1932, introduced a small half-wave tube, the oddly named "Type 1." Within a few weeks they had taken the mercury out, calling the result the "1-v." The 1-v had decent success in AC-DC radios. Also in 1932, RCA brought out the 82 and 83 full-wave rectifiers. The 82 found its way into some large home sets. On checking the "Radio Finder" page on John Okolowicz' site, *www.grillecloth.com*, 179 models from the 1930s turn up. The larger 83 is normally thought-of as used in PA amplifiers (compared to high-vacuum tubes, it gave a relatively "stiff" output voltage in the face of varying loads like a Class B amplifier). It appeared in 56 radio models. The 83 stayed on in tube testers into "modern" times. The 82 and 83 had

Rectifier cabinet in GE-built RCA 50A transmitter at WTIC, showing six 857s (from a GE press release of 1929).

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high-vacuum variants (82-V, 83-V), but these were not big sellers.

One odd application popped up for a mercury tube in the early 1950s: the Workman TV "5TV4 B+ Booster." This device, intended to replace the regular 5U4G in a TV set, offered less voltage drop and thus some margin against low power-line voltage and the resulting picture shrinkage. On close examination, this unit turns out to be an 83 placed on an octal base, with a pair of 350-ohm "Globar" temperature-sensitive resistors in series with the plate leads. The resistors gave a "soft-start" feature when the set was turned on. The whole thing is coated in gray Aquadag, giving the tube an air of mystery.

STOP
BLACK BORDERS
ON TV PICTURE
use a
"B" Plus Booster
Model 5TV4 Replaces 5U4G
Anytime!
Pulling a Tube beats
Pulling a Chassis
Built-in Time Delay to Protect TV Set
Write for free information
THE 5TV4 GETS RESULTS
• SUPPLIES EXTRA 35-40 VOLTS TO LOW VOLTAGE SUPPLY
• GIVES FULL SIZE PICTURE WHEN LOW LINE VOLTAGE OR WEAK TUBES CUT PICTURE SIZE.
• GIVES EXTRA GAIN NEEDED IN FRINGE AREA
STANDARD R.T.M.A. GUARANTEE
PAT. APPLIED FOR
WORKMAN
TV
Sold Through Authorized Distributors Only.
List Price $6.60.
TEANECK, NEW JERSEY

From a promotion for the 5TV4 TV Rectifier (source unknown, probably Radio & Television News*).*

Hot-cathode mercury tubes were touchy to apply, requiring vertical-only mounting and liberal preheating time before application of the high voltage. They were critical as to the temperature of the extra mercury condensed in the bulb. They did not start reliably or give full life if too cold (below 68°F, say), and tended to "arc back" when too hot (above 160°F, for example). This led to development of argon- and xenon-filled tubes (the 3B28, 4B32, etc.) for military use in WW II. Mercury remained a satisfactory choice for most industrial uses—electroplating, control systems, servo systems, and so on—until the solid-state era.

A substantial market grew up for plug-in silicon replacements for rectifiers. The International Rectifier Company, for example, registered a line of devices (1N2630 through 1N2637) [3], intended to replace a wide range of tube rectifiers, both high-vacuum and gas-filled. The line came with 4-, 5-, and 6-pin bases, plus 7-pin miniature.

The 1N2637 could displace the 866/866A mercury tube, the argon 3B28, and the WE mercury 249B. The transmitter maker Wilkinson Electronics later offered plug-in substitutes for larger tubes (872A, 6894, 869B, and even the mighty 857B). Changing-out the 857Bs in a 50-kW transmitter would save 900 watts in filament power alone. This was an odd self-liquidating market: once all the tubes were displaced, the demand for the replacements should have vanished.

Returning to mercury-arc rectifiers: a few survive in tube collections, so a caution is in order. The old-time directions for handling these pointed out the need to handle them gently, as a "mercury hammer" effect could develop and break the glass. The tubes are treacherous to handle because there is perhaps a pound of mercury sloshing about inside, causing the center of gravity to be always moving around. Breaking one of these devices would turn the workspace into an instant HAZMAT site.

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3. Release 3659, Joint Electron Device Engineering Council, Electronic Industries Assn., March 26, 1962.

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EQUIPMENT RESTORATION

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Submit restoration tips in Word, WordPerfect or plain text files with any illustrations in separate jpeg , tif or bmp files (not embedded in document).

Restoring a General Electric Colorama Radio

Part 2: Testing the Radio and Restoring the Cabinet

Do the Colorama tuning and AFC work and enhance the interest of this receiver? Yes, the color changes from red to green upon tuning in a station, though not always to as intense a green as the system is capable of displaying. When the set is first turned on before warmup, the green bulbs on the secondary side are at their maximum intensity and the green color is quite intense when no dc current is going through the primary of the saturable core transformer before the B+ arrives on the primary side.

Typically, most stations are not strong enough to produce this intense green light upon tuning, but for a very strong station the effect is very dramatic. Another radio that used a saturable core reactor to control a tuning lamp was the Majestic 360 (circa 1933), though it did not use the color feature and used the plate current of an IF tube rather than a separate control tube current for the SCR primary. It relied only on brightness of a lamp to indicate tuning. Sets with eye tubes and shadow tuning meters were more common. Later GE sets used the tuning eye tube. It would seem that cost of the tube and transformer destined the Colorama tuning toward obsolescence.

The AFC is useful. Once the radio is tuned close to the desired station the AFC locks in the tuning and the lights go to the green condition. When adjusted correctly, it does work and will counteract tuning drift. A switch is provided on the front panel to disable the AFC when desired. My tests indicated that once the tuning was within about 25 kHz of a strong station, the AFC would pull the station into tune.

This feature involves a Foster-Seeley discriminator, which is a detector more common in FM sets and its use for AFC was probably an advanced feature not seen in many AM radios. One leg of the detector produces audio from an AM signal and the difference signal for the two diodes is used to produce the voltage for frequency correction to shift the converter oscillator slightly. Part of the alignment procedure is subtle tuning of the final IF transformer to insure that off-frequency tuning produces the proper voltage polarity to tweak the tuning oscillator enough to bring the station back into tune.

Rear view of nearly finished radio showing PVC cans in place. Cans and power transformer not yet painted.

Give credit to GE for good execution of this advanced feature. And moreover, the feature worked initially in my set without performing any alignment or adjustment of the circuitry, so it apparently remains in good adjustment over a long period. However, after replacing some capacitors I found the circuit didn't perform as well and required the adjustment recommended by GE. Described in Rider's and the GE Service Manual, it consists of a critical adjustment of the tuned circuit just in front of the discriminator/detector. Once the radio was playing reasonably well, I completed my restoration by replacing the damaged top veneer, restoring the toned accent areas of the cabinet at the base and along the vertical edges, and replacing the grille cloth.

I used a rotary fabric cutter to deeply score a straight line across the top veneer just back of the curved veneer going from the face of the cabinet to the top. I did this so I could butt new veneer against the old along a straight line. A sharp box cutter could be used but the sewing cutter loaned to me by my wife was a better option, cutting more exactly with less pressure.

Front view of the restored GE Colorama (Model 101) radio.

The damaged top veneer was then removed with a flat chisel. Because it was on a center area that was raised about ⅛ inch above the areas to its right and left, the new veneer was a square about 10×10 that only had to butt on one line (the scored cut) against the old veneer. Two of the sides were raised about the remaining old veneer and the fourth side was along the rear edge. Consequently, three of the sides of the new veneer could be trimmed in place after gluing it down and only one side had to mate with the old veneer during gluing. I also glued down some loose veneer on the underside of the cabinet, repaired some minor divots in the cabinet using shellac sticks, smoothed the surface a bit with light sanding, stained it with NGR and sprayed some lacquer over the entire cabinet. The cabinet was masked with newspaper/masking tape to expose only areas to be toned on the base and vertical corner molding on the front. These areas were toned with a dark walnut toning lacquer.

I encountered some minor problems with the Candohm resistor strip, which seemed to occasional lose continuity, causing audio noise. But it remained ok for the most part. The previous owner had inserted two resistors, a 100 ohm and 30 ohm to partly correct this problem and I left these two resistors in place. Replacement of the Candohm strip would be a major undertaking since new resistors would have to be well anchored. The most reliable fix would be to replace the whole unit consisting of 5 legs of resistance of 5 to 7 watt rating, each tied to an insulated strip. This is a task for the future if the current configuration becomes less reliable.

In general I found this radio was a cut above many, both with respect to the mechanical aspects of the tuning mechanism and the electronics. With its 10 tubes it included most of the essentials of a top-of-the-line set, namely a tuned RF stage, two IF stages and the tuning aids of the Colorama system and AFC. The audio output with a single 6L6 produces more than enough power to drive the 8 inch speaker well beyond comfortable levels.

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RADIO REHAB 101

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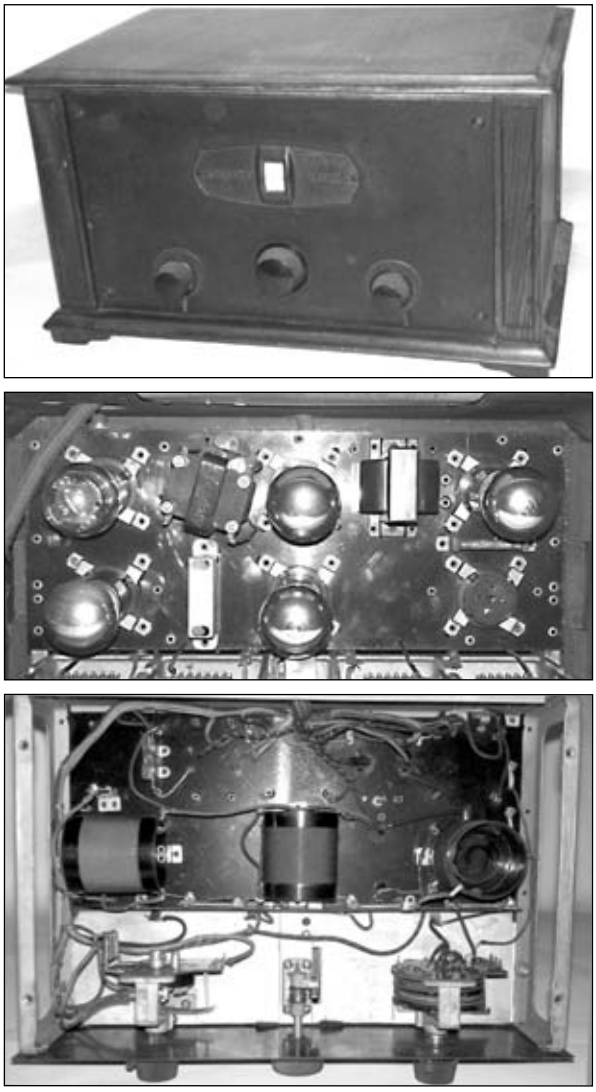
Lonely and Unloved—Investigating an Old Kolster 6D: Part 1

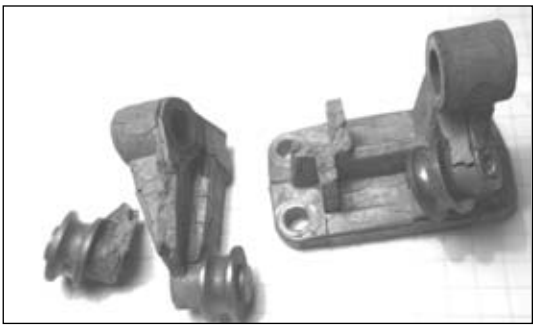
My Dad used to tell me about his first radio—a 1926 Kolster he got as a Christmas present while he was in high school. He listened with earphones until he got married, then splurged on a Philco 180 console. The Kolster table set cost about $85 without a speaker, and it was an up-to-date TRF design with single-knob tuning, six tubes, and "no howling."

Behind the scenes there was trouble, though. Seven- and eight-tube Kolster brand radios were built by Brandes, subcontracting for the Federal Telegraph Company, for whom Frederick Kolster was a lead engineer. But distributors were sending those radios back at a 60% rate[1]. So Mr. Kolster designed this low-cost six-tube set. An AC model came along in 1927. By 1929, three million dollars worth of unsold sets were on Brandes' hands, and these were dumped at discount.

Not a pretty story, but it happened often in the free-wheeling days before the Crash took place in October 1929. Nevertheless, a lot of Kolster Model 6s and variants were sold. They are plenty cheap on internet auctions, and the radio forums have a



Front, inside top, and bottom views of the Kolster Model 6D as found (see text).



Variometer (left) and tuning shaft brackets as removed from set.

lot to say about them. How were they made and how do they perform? I dug out one of my two Model 6Ds to see for myself.

An inside view of the set shows a few nice details—including spring-mounted sockets for all the tubes (not found on early production) and a monster four-gang tuning cap within a metal (zinc?) casting that accounts for a good deal of the receiver's weight. Rather advanced for 1926, considering the market.

A look underneath shows open wiring and the typical three-axis mounting for three tuning coils. Components and tubes mount on a phenolic panel. A fourth tuned circuit is the variometer seen at the lower right, allowing for fine tuning of the RF input stage by front panel control.

But the worst problem—a fatal one now—was Kolster's use of the dreaded "pot metal" in key components of the radio: the body of the rotary tuning dial, and the brackets for the variometer, filament "volume" control and tuning knob. You can melt pot metal with your soldering gun. Over the years, these parts have swelled, cracked, and changed shape with age. This has led to shaft binding and failure. You can easily see the cracks in the photos of these parts as removed from one of my sets.The tuning bracket fell apart when I removed it from the chassis. Deformation of the other brackets is apparent as well. The rotary dial was even worse. As-is, the set was DOA. You literally can't give these sets away today[2]. What to do? A full restoration might be possible[3] if I had access to a milling machine and retained skills I had in my youth. Outside of the two open audio transformers, the electrical bits were probably still OK. An external power supply and contemporary speaker would be no problem. The cabinet is solid and would look nice if refinished, even by me.

I decided to rebuild this receiver while keeping its outer appearance. I like old radios for their appearance and for their historic significance, but this one is a lonely, unloved orphan. I could give it new innards, same as when the docs gave me a titanium knee, and someone will enjoy it same as I now enjoy my knee. I would give

Corner insulator discovered during dismantling might have been included to prevent the metal chassis from acting like a "shorted turn," reducing the Q of the RF coils.

The refinished Kolster cabinet with the "All American 5" set built inside.

it to my Dad if he were still here. Purists can tune out now!

I have plenty of parts in my junk boxes, and I dug out enough NOS and used parts to build a five-tube broadcast superhet on a new chassis while using the front panel arrangement as original. The biggest problem turned out to be fabricating a rotary dial drive for the tuning capacitor.

An odd detail I discovered during the demolition phase was a fiber insulator (see photo) at one corner of the steel chassis foundation. I believe it was intended to avoid establishing a shorted turn that might reduce the Q of the array of RF coils within. Imagine the Kolster lab engineer's pride at having added that feature. More on this in Part Two.

As mentioned, by far the hardest part of this conversion to a modern tube superhet chassis was the reconstruction and fabrication of that new tuning dial and its linkage to the central tuning shaft. The new two-gang tuning cap I chose has a nice four-inch pulley already mounted, and I wanted it to carry a replacement rotary dial scale like the original.

The resulting arrangement of little pulleys, chassis cutouts, dial stringing, and even an offset stationary jackshaft-like standoff that I needed to make it all work, resulted in an assembly resembling something between a Kafka novel and a MENSA entrance exam. And wild horses could not make me reveal the chassis wiring here in the *Journal*. The set looks pretty good from outside, though. And yes, the dial plate comes from my other Kolster.

Inside, you can see the five-tube layout with a loop antenna from a modern "All American 5" radio Velcroed to the inside back panel. Two banana jacks allow connection to an external PM speaker with its output transformer. There's a one-amp line fuse on the chassis near the loop, and you can just see part of the new rotary dial at the bottom of the picture. The dial has four illuminating LEDs.

The set works as well as most table radios, and sounds fine with a decent speaker in a period enclosure. It's intended as a wedding present, but I'm afraid the happy pair may wonder why it only gets AM stations. I guess I could have stuffed in an old AM/FM chassis and used flexible shafts—no, that way lies madness!

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1. *Radio Manufacturers of the 1920s*, by Alan Douglas, Vol. 2, p.115.
2. There are occasional exceptions. See http://radioattic.com/item.htm?radio=0380204; Someone paid $385.00 for a nice-looking 6D in April of 2009. I will be glad to sell the other one of mine at that price if asked.
3. An intrepid Frenchman has apparently restored a Kolster 6D with newly-fabricated parts. See http://www.cfp-radio.com/restaurations/kolster6D/kolster6D-03.html

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BY P.A. KINZIE

WIRELESS COMMUNICATION BY EARTH CONDUCTION IN THE EARLY 1900S

Part III: Related Inventions and Business Efforts

A number of scientists and inventors experimented with wireless communication using small scale systems and earth conduction; these were described in Parts I and II of this series. However, information about efforts to produce and sell practical equipment was found for only three individuals among those that participated: James Tarbotton Armstrong, Axel Orling, and Nathan B. Stubblefield.

Armstrong and Orling first worked together on extended applications of their Armorl system and attempted a business operation. Orling later adapted the most important invention, the electrocapillary relay, to use in a recorder for employment by the undersea cable companies and began his own business.

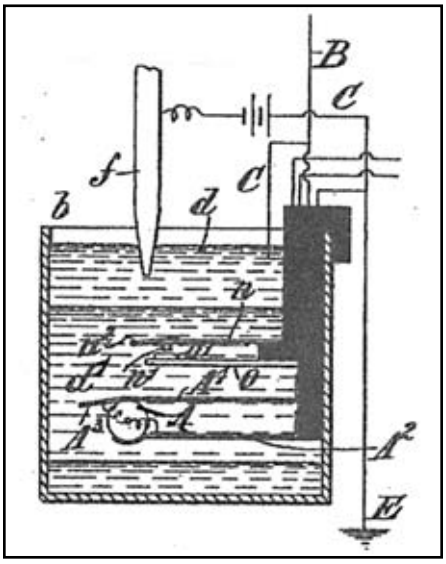

Fig. 1. Original form of capillary relay intended for use with a coherer in a wireless telegraphy receiver. (From ref. 1)

Stubblefield became briefly associated with a company that intended to sell earth conduction telephones, but soon dropped further conduction work, and no commercial developments resulted from his later activities. The business interests of the three individuals are discussed here, and in the case of Armstrong and Orling, the adaptations of their inventions to aid these efforts are also covered.

The Armstrong-Orling electrocapillary relay was arguably the most sensitive relay developed up to that time, and the inventors expanded its range of applications beyond the limitations of earth conduction by using it together with a coherer as a detector for space telegraphy reception. A detail for one of the early designs from their United States patent[1] is shown as Figure 1 to give a general idea of the apparatus. The poor quality of the patent copy makes it difficult to understand the operation of the detector, even when using the step-by-step description in the patent, so a generalized description is given here.

Two immiscible liquids contained in a vessel are in direct contact at their interface, and a coherer is immersed in the lower, nonconductive liquid. According to the patent this can be carbolic acid, which is heavier than the upper conductive liquid such as a solution of wine and potassium iodide. Mercury droplets fall from capillary f, shown in the figure, when current is applied through the conductive liquid and the capillary. These first strike a relay upper contact, then fall and strike the coherer for decohering action. The relay actuates a conventional audio device or ink recorder.

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No details were found regarding actual experiments with this design, but more information was available about an improved relay, one version of which was used for wireless telegraphy experiments. This relay employed a container for a dilute acid solution, which included a minute hole in the bottom that was normally plugged with a small globule of mercury. When a droplet from the capillary fell through the solution and reached the globule, a corresponding droplet pushed its way through the hole, passing between two metal points to momentarily allow current flow around an external circuit[2]. This part of the unit, as well as some other versions, was later described with accompanying diagrams in another publication[3].

Author H. C. Marillier[4] discussed the apparatus in detail, and commented that he had watched the relay operate with an extremely small input current. He quoted an Armstrong-Orling claim that they were first to observe that the coherer could be used in a noncohering mode with such small currents. Of course this meant that the Armstrong-Orling receiver could detect much smaller signals than the conventional coherer circuit.

It appears that the inventors made no formal claim about priority of invention, and Marillier pointed out in a footnote that Chunder Bose had described the same effect in a paper read before the Royal Society somewhat earlier in 1899. It can be said that Armstrong and Orling were among the few investigators at that early date with full understanding that the coherer had a second operating mode below the threshold current at which the particles cohered. However, the few were soon joined by a number of others, because by 1902 a note in *Electrical Engineer* described work by M. A. Rochefort investigating conditions where coherer particles behaved in that manner[5].

As was typical of Armstrong and Orling, they did not describe the space telegraphy receiver in detail during public events, but it is evident that its high sensitivity depended upon operation of the coherer as a half-wave detector for very low signal levels.

One author quoted a remark made by them that it could respond to currents which telephone instruments could not detect[6], and was the most sensitive device at that time for responding to audio signals. The same source remarked that if used for a range of more than twenty miles, antenna height would need to be only a tenth that of a Marconi installation.

Marconi's wireless telegraphy system was already in commercial operation at that time for ship-to-shore communication along the English coast, and the inventors may have been referring to that type of installation. No field demonstrations were made to back up that claim, although tests had been conducted with equivalent circuits to simulate the transmission of signals over extended distances. These gave evidence of a capability for such reception[7].

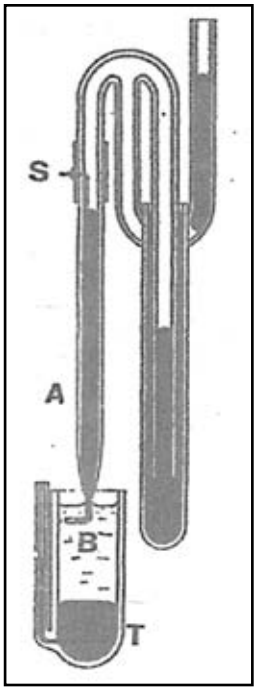

Fig. 2. A substantially improved electrocapillary relay used in the Orling-Armstrong recorder. (From ref. 8)

Substantial changes in the construction of the electrocapillary relay led to its use in what came to be called the Orling-Armstrong recorder, a versatile piece of equipment that was adaptable for all telegraphy uses. An article about the new unit appeared on August 19, 1904, shortly after an early presentation[8]. The relay for the new apparatus was considerably simplified compared to earlier versions, and a diagram of its initial form appears as Figure 2.

The mercury contained in tube A extends into the horizontal capillary B, and by

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adjusting the amount of mercury in the other vertical tubes the mercury meniscus at the end of the capillary column extension is properly positioned. Electrical connections are made by means of a platinum wire sealed into the glass at S, and by connecting to the pool of mercury at T.

It is noteworthy that falling droplets of mercury were no longer required for relay operation. Movement of mercury back and forth in the capillary, depending upon the magnitude and direction of the current, was used for signal response. With the aid of a light source and an optical system, an incoming signal could be continuously recorded on a strip of moving photographic film.

The recorder was intended primarily for the purpose of receiving high-speed undersea cable or landline signals, but it was said to be adaptable to space telegraphy with the aid of a coherer. A later publication discussing an improved model described it as having been used with the Marconi magnetic detector, the Lodge-Muirhead coherer, and the de Forest electrolytic cell[9].

Patent coverage for another advanced relay design included the changes diagrammed in Figure 3, reproduced from the patent[10]. Movements of rods k and 1, in the diagram, adjust the position of the mercury meniscus near the tip of the capillary h at the end of the tube f. Electrical connections are shown at i and j.

The patent also gave details about the optical system for the photographic recorder, and described the method for converting the optical output from light to electrical current for direct measurement or an audio output. This consisted of using a light sensitive selenium cell or its equivalent in a local battery operated circuit.

The evolution of the Orling-Armstrong recorder from the earlier electrocapillary relay was accompanied by business applications, based on the Armorl system. Armstrong and Orling had a business venture in mind early in the development of the system, and this no doubt affected the presentation of the first public demonstration in October of 1901. Much favorable commentary followed in the press[11, 12, 13, 14], but

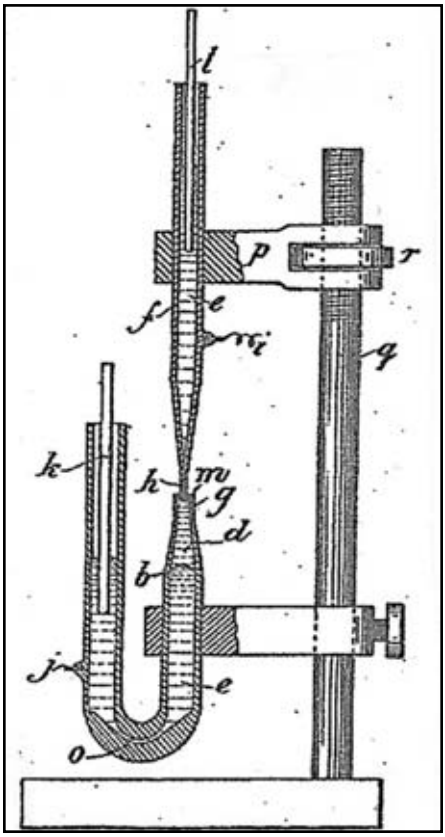

Fig. 3. Another advanced design relay for use in recording systems. (From ref. 10)

few technical details were given. Armstrong may have indulged in exaggeration, and some published reports were clearly in error.

The latter appear to have been produced by reporters and editors with little technical knowledge, and as a result they invited criticism in other publications. In fact, the situation reached the point where an investor oriented article that cautioned about opportunities in wireless telegraphy singled out the Armorl system as an example of what to avoid, referring to British newspaper articles as hysterical enthusiasm[15].

Mixed opinions about the Armorl system had no obvious effect upon plans by the inventors for a commercial venture. This became evident in July of 1902 when a note in

the publication *Nature* described the new company about to be registered with the intention of manufacturing and supplying Armstrong-Orling transmitters and receivers[16].

In retrospect, a decision to manufacture was premature, if not unwarranted, in view of the early stage of development at that time, and a limited potential market at best. Sales of equipment for wireless telegraphy would have faced formidable competition from Marconi's company, already in commercial operation.

Also, the only ready market for an earth conduction telephone was in remote areas where there was no local service. Major obstacles existed for use in regions where a large number of telephones would be in range of one another, and where there would be competition with existing landlines. Concerning the proximity of many telephone stations, little had been said about the problem of conveying more than one message at the same time without interference.

An article that briefly discussed such selective operation[17] attributed an explanation to Armstrong that seems questionable at best. A similar questionable claim for earth conduction telegraphy was described in Part 2 of this series. Perhaps work in progress was being mentioned that never proved successful.

These problems did not deter Armstrong from initiating the General International Wireless Telegraph and Telephone Company, Ltd. Later information confirmed that this firm, was to all intents and purposes completely controlled by Armstrong at first[18], even though there were a number of shares of stock held by other individuals.

Given this situation, Armstrong was facing problems from the outset, which was shown by news coverage about manufacturing. One publication stated that the company was already manufacturing and selling instruments[19], and another that it was in "immediate readiness" to supply equipment[20]. Shortly thereafter, yet another source indicated that equipment would not be available for over six months[21].

In November of 1902 a Canadian periodical quoted extensively from the British *Westminster Gazette* description of a catalog and price list said to have been issued by the Armstrong-Orling company[22]. Some of the prices had been left blank, suggesting that the catalog was actually a preliminary copy. Both telegraph and telephone products were described, some items with prices that would be affordable for most individuals.

Earlier, *The American Telephone Journal* referred to a British newspaper having obtained an advanced proof copy of a catalog[23], which may have been the same as the one described above. The price of a complete short distance telephone installation was quoted as costing $20 per year, along with an annual royalty of $5.00.

No evidence has been found that a final version of the catalog, or of similar advertising, was released to the public. This leaves in doubt whether there was ever any significant manufacture and sale of company products. In fact, it appears that during the next three years or so that the company remained active, its operations consisted of development work, which was known to be the cause of an ongoing shortage of funds.

Armstrong had received a large block of stock after assigning most of his patents and other business assets to the new corporation, but because of the shortage of funds, he began selling shares of his stock for cash. He also traded blocks of stock for services, this activity being intended to support product development. The process continued to the point where he not only lost his control of the company but also had to assign his remaining stock to creditors.

Later, a British government official had harsh words about Armstrong in this respect, referring to such company financing as a "rash and hazardous speculation[24]. Armstrong's affairs reached such a low point that he appeared for personal bankruptcy in 1905, with continuance for two more years in 1906[25, 26]. This period included the time when Armstrong in effect ended his development work in the wireless field, with a possible exception of some support given to Orling in the development of the Orling-Armstrong recorder.

The joint venture begun by Armstrong

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and Orling still appeared to the public as company activity well after Armstrong lost control. As for Orling, it is not clear just when he began a process of disassociation from that organization, but it may have been during the development of the recorder.

That instrument included the improved electrocapillary relay, but development was not directed primarily toward use in short-range earth telegraphy systems, as was discussed earlier, and this may have been influenced by Orling's diverging interests. An early presentation of the recorder was given at the offices of the Armstrong Company in August of 1904[27]. At that time, Orling was probably beginning to follow his own path of developing specialty devices for undersea cable operations.

The recorder was later shown at a Royal Institution exhibition and cable application was discussed in great detail, but nothing was reported about coverage of space telegraphy[28]. Then, with the help of a number of investors, a new company, Orling's Telegraph Instruments Syndicate, Ltd., was incorporated in June of 1906[29], and he began an active career of inventing and supplying devices to the cable industry.

In the United States, the first earth conduction telephone invention to reach the level of a business opportunity was Nathan B. Stubblefield's development. He was considering a sale of his invention in early 1902[30], and later on in the spring he entered into an agreement with the Wireless Telephone Company of America, giving the company exclusive rights to his invention in exchange for a large block of stock[31]. There were other commitments made by both parties, which included services by company promoter Gerald M. Fennell.

The company, newly incorporated in Arizona Territory by three New York investors[32], also supplied cash, with publicity supplied by Fennell, who also aided Stubblefield with his demonstrations. However, the agreement was a brief and uneasy one for him, as he was concerned about Fennell's aggressive promotional activities. Such concern was well founded, because when he was preparing for a demonstration in New York City and unanticipated difficulties arose, Fennell proposed making concealed wire connections between the transmitter and the receiver to solve the problem[33].

This suggestion, and other unacceptable behavior on the part of Fennell, prompted Stubblefield to sever all ties with the company. The return of company property was included, and it also meant that the invention rights to the earth conduction telephone remained with that organization. This marked the end of his experiments with that type of telephone, even though subsequent events indicated that he could have continued.

In fact he may have considered doing so somewhat later, after learning that the company had gone out of existence. At that time he had a notice published locally, stating that his inventions had reverted back to him and that they were "soon to be exploited under quite a different management[34]. Stubblefield did resume work on a wireless telephone and later applied for a patent[35], but it was based on the inductive method of transmission which he had first considered years earlier, either before or during work with conduction.

There were additional conductive and inductive methods of communication developed by others, but these took place later on during the 1900-1910 period and did not result in long term establishment of successful companies. The simplicity of the conductive method, which was always so attractive in terms of initial experiments, could not be translated into something that was competitive with existing wired systems, or with the new technology of space telegraphy.

It is true that wireless telephony was still developmental in that early period, but it appears that too few practical applications existed fitting within the short range limitations of earth conduction to support commercial activity.

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BY ERIC P. WENAAS

WHAT'S "DE" STORY ON THE SPELLING OF LEE DE FOREST?[1]

Part I. De Forest's Autobiographical Account

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From time to time I am asked why I spell Lee DeForest with a capital "De" as I am generally wont to do. The question is invariably prompted by the general belief that Lee in his autobiography published in 1950 conveyed a desire to have his surname spelled with a small "de" as in de Forest.[2] Lee addressed the spelling of his name only once in his autobiography—and that was in a footnote to his father's name, which Lee spelled as Henry Swift De Forest with a space between "De" and "Forest" followed by an asterisk referring to the following footnote: "My father and grandfather preferred to capitalize the D. While at Yale my brother and I resumed the style of earlier generations."[3]

In the accompanying text, Lee claimed that the style of earlier generations flowed from Isaac de Forest, the first generation of Lee's lineage to be born in America. Lee wrote that "the de Forest clan" sprang from Isaac de Forest; that David de Forest, son of Isaac, moved to Stratford and founded the Connecticut branch of the family; and that Gideon de Forest, Lee's great grandfather born in 1765, moved to Edmeston, NY and established the de Forest homestead there.

Since Lee spelled his ancestors' surnames "de Forest" and his father's surname "De Forest," the clear implication is that Lee changed the spelling of his surname from De Forest to de Forest while at Yale. Many readers and historians have interpreted the two short sentences in the aforementioned footnote of Lee's autobiography to mean that he preferred to spell his name de Forest.

If that interpretation is correct, then why was the capital "De" form used so often by Lee himself and other authors during his lifetime, and why is this form still used so prevalently today? The answers to these and other questions are addressed in a series of articles about "de" spelling of de Forest. It will be shown that Lee used the "De" form of spelling for his name at least as often as the "de" form, and the vast majority of references to Lee as individual in documents generating during his lifetime used the capital "De" form—a practice that has been continued by a number of historians and authors to the present day.

Since Lee never explicitly expressed a preference for the spelling of his name, the objective of Part I is to examine whether Lee implicitly expressed such a preference in his autobiography. The article is divided into four sections with the objectives of determining: 1) the spelling of Lee's family surname, 2) the spelling of Lee's surname from birth through his years at Yale, 3) the spelling of the surnames of Lee's earlier generations, and 4) if and when Lee resumed the style of earlier generations. In the remainder of this article, I will use either Lee and/or his surname spelled DeForest—the spelling that I prefer and one that Lee and others so often used.

The DeForest Family Name

It should not surprise anyone familiar with Lee's autobiography that virtually all the statements he made there regarding the spelling of his name and the names of his ancestors were found to be inconsistent with reliable documents and other artifacts. To begin with, Lee was incorrect about the spelling of both his father's and grandfather's surnames as well as his own. In fact,

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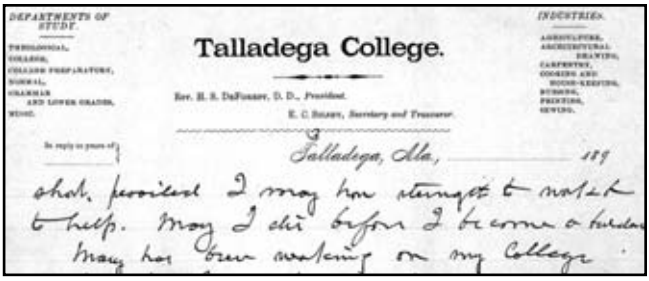
all three were spelled DeForest—not De Forest as he asserted. It will be shown first that Lee's father, Henry Swift, spelled his surname DeForest without a space.

The most useful documents for determining the presence or absence of a space after "De" in the DeForest surname are those that are printed as opposed to those using cursive writing. The DeForest name appearing in cursive writing, whether it be signatures or records entered by clerks, was generally executed by repositioning the pen to the top of the line for the capital "F" in Forest after the stroke at the bottom of the small "e" in "De," and in doing so almost always left a space between "De" and "Forest." Thus, it is almost impossible to distinguish between the DeForest and De Forest forms of spelling from cursive writing.


Talladega College.

Talladega, Ala.,

Fig. 1. Lee's father, Henry Swift, spelled his surname "DeForest" on his personal stationery as president of Talladega University. (Lee & Marie de Forest Papers, H.S.J.)

The spelling of DeForest's father, Henry Swift, can be traced back to the time when he attended Yale University during the academic years 1853-58. His name is spelled DeForest without a space in the Catalogue of the Officers and Students of Yale College for each of the five academic years that he attended Yale.[4] All these catalogues contained at least one reference to the De Forest form (with a space) in addition to the DeForest form (without a space), providing strong evidence that the two forms were not aggregated by the editors.

Additional evidence for the proper spelling of Henry Swift's surname can be found in twenty or so documents published by a variety of different organizations, including publications by Talladega University where he served as president from 1880 until his death in 1896. While all have only the DeForest spelling for Henry Swift, the seven cited here are those that have entries for both forms of the spelling, indicating that the two different spellings were not aggregated under the DeForest form by the editors.[5]

Perhaps the most compelling evidence comes from artifacts imprinted with the DeForest spelling that were personally selected by Henry Swift, his wife, or other immediate members of his family. For example, Henry Swift had stationery printed while he was president of Talladega with his name spelled DeForest without a space in the letterhead (see Fig. 1).

Fig. 2. Henry Swift's name appearing on his grave marker in Greenwood Cemetery in New Berlin, NY is spelled HENRY SWIFT DEFOREST D.D.

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Fig. 3. The family surname appears as DEFOREST on the grave marker of his two sons located in Greenwood Cemetery in New Berlin, NY.

Another example is the engraving on the grave markers of the DeForest family members, many of whom are interred in the Greenwood Cemetery in New Berlin, NY near the DeForest family home in South Edmeston. The name on Henry Swift's grave marker is carved as "HENRY SWIFT DEFOREST, D. D." with no space after DE (see Fig. 2).

Another marker spells the names of Lee's uncles, Edward and Mills, as well as those of his grandfather and grandmother as DEFOREST without a space (see Fig. 3). (Lee's grandfather's given name was also Lee.) This marker is. particularly relevant because Lee said in his autobiography that he visited this family gravesite when he was a young boy, and this marker, placed there in 1848, would have been there for him to see.

Spelling of Lee DeForest

Lee's birth certificate could not be located to assist in verifying the spelling of his surname at birth[6], but it is axiomatic that it would be the same as that of his father. Perhaps the earliest published records of Lee's name appear in catalogues prepared and distributed by the Mount Hermon Prep School in Massachusetts, which he attended in the academic years 1891-1893. The available Mount Hermon catalogues, which cover the period from 1899 to 1906, have four entries for Lee where his name is consistently spelled DeForest.

Lee's name is also consistently spelled DeForest in all catalogues published during the academic years that Lee attended Yale as an undergraduate (1893-1896) and as a graduate student (1896-1899). Unfortunately, these Yale catalogues do not distinguish between the spellings DeForest and De Forest; the editors aggregated both forms of the spelling under the single form DeForest. However, this editorial policy combining all DeForest spellings under a single form was discontinued with the second quinquennial edition of the catalogue covering the years 1701 to 1915.[7]

This edition is remarkable because it was the first one to distinguish among all three of the most common forms of the spelling: DeForest, De Forest and de Forest. Since Lee's name was spelled DeForest on separate pages that listed him graduating with a Bachelor of Philosophy in 1896 and with a Doctor of Philosophy in 1889, it represents rather conclusive evidence that he was registered as Lee DeForest the entire time he attended Yale—not De Forest or de Forest.

Perhaps the most definitive evidence that Lee preferred the DeForest spelling while attending Yale comes from the Yale Scientific Monthly, a technical journal founded by senior students in 1894-95, the academic year when Lee was a junior at the Sheffield College of Yale University. This journal was funded by sales to students and under direct editorial control of senior class students—not Yale University—thereby giving the editors a great deal of autonomy.

Lee DeForest was an editor of the magazine during his senior year at Sheffield (1895-96), and his name appeared on the masthead of each edition of the journal that school year with the DeForest spelling, presumably the spelling he preferred (see Fig. 4). Even more convincing are two technical papers DeForest published in the Yale Scientific Monthly, one in the May 1895 issue with the byline "Lee DeForest,"[8] and the

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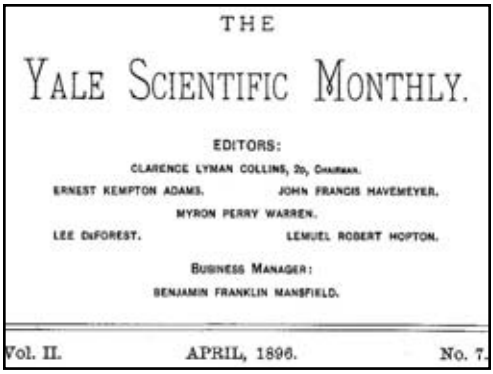
second published in the May 1896 issue with the byline "L. DeForest."[9]

Evidence that Lee continued his preference for the DeForest spelling right up to the time of his graduation from Yale comes from his thesis, which was published in the American Journal of Science in 1899 just after his graduation with the byline "Lee DeForest."[10] Both of these journals were found to distinguish between the DeForest and De Forest forms of spelling, again indicating the spellings were not aggregated by the editors.



THE

YALE SCIENTIFIC MONTHLY.

EDITORS:

CLARENCE LYMAN COLLINS, 2D, CHAIRMAN.

ERNEST KEMPTON ADAMS. JOHN FRANCIS HAVEMEYER.

MYRON PERRY WARREN.

LEE DeFOREST. LEMUEL ROBERT HOPTON.

BUSINESS MANAGER:

BENJAMIN FRANKLIN MANSFIELD.

Vol. II. APRIL, 1896. No. 7.

Fig. 4. Lee DeForest's name appeared on the masthead of every issue of the Yale Scientific Monthly as "Lee DeForest" in the academic year 1895-6 when he was an editor.

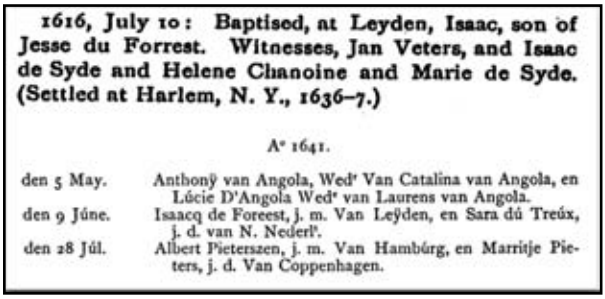
Spelling of Lee DeForest's Ancestors

Lee mentioned several examples of earlier generations that he claimed used the de Forest style of spelling. These included Isaac de Forest, born in Leyden, Holland and the first to emigrate to America (in 1637), where he settled in Dutch New Amsterdam (now Manhattan); David de Forest of Stratford, a son of Isaac and the first DeForest ancestor born in America; and Gideon de Forest, Lee's great grandfather.[11] Referring to Isaac de Forest, Lee stated: "In 1641 he (Isaac) married Sarah de Truit of New Amsterdam, spinster. From this union sprang the de Forest clan."

However, it turns out that neither Isaac nor any of the "de Forest clan" in Lee's lineage that sprang from this union spelled their surnames de Forest. According to church records in Leyden, Holland, Issac's surname was spelled "du Foreest" when he was baptized in Leyden on July 10, 1616.[12] On June 9, 1641 four years after emigrating to New Amsterdam, Isaac married Sara dú Treúx, but according to church records of this marriage, Isaacs's surname was spelled de Foreest, not de Forest.[13] Both records are reproduced in Fig. 5. From 1642 to 1660, Isaac's surname appeared many times in the printed records of New York with the "de Foreest" spelling, but never as de Forest.[14]

The spellings of the next three generations of Lee's ancestors, David, Samuel, and Joseph, who lived in Stratford, CT, can be found in an often-quoted book containing an appendix with original land and baptismal records from New York and Connecticut.[15] Isaac's son, identified by Lee in his autobiography as David de Forest of Stratford, was baptized on Sept. 7, 1669 in New Amsterdam as David de Foreest.

David moved to Stratford, CT in 1697 at age 28 and created the Stratford branch of the family. An entry in the Congregational



1616, July 10: Baptised, at Leyden, Isaac, son of Jesse du Forrest. Witnesses, Jan Veters, and Isaac de Syde and Helene Chanoine and Marie de Syde. (Settled at Harlem, N. Y., 1636–7.)

Aº 1641.

den 5 May.	Anthonÿ van Angola, Wedº Van Catalina van Angola, en Lúcie D'Angola Wedº van Laurens van Angola.
den 9 Júne.	Isaacq de Foreest, j. m. Van Leÿden, en Sara dú Treúx, j. d. van N. Nederlº.
den 28 Júl.	Albert Pieterszen, j. m. Van Hambúrg, en Marritje Pieters, j. d. Van Coppenhagen.

Fig. 5. According to Lee, the de Forest clan sprang from the union of Isaac de Forest and Sarah de Truit, but the original birth record from Leyden, Holland (upper) and the original marriage record from New Amsterdam (lower) show that Isaac's surname was spelled "du Foreest" at birth and "de Foreest" at the time of his marriage.

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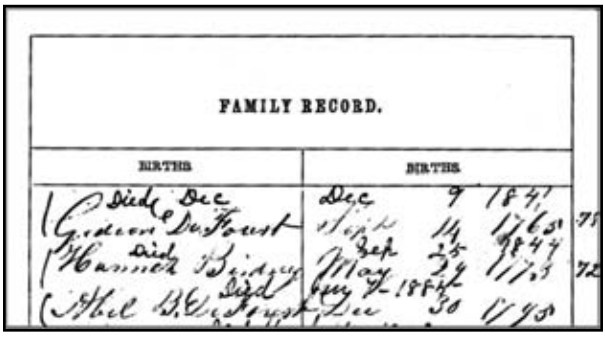
Church records in 1697 indicates that his name had morphed to Deforest by the time he arrived: "Mr. Deforest and his wife Martha were covenanted and baptized on August 7, 1697." Thereafter, his name also appeared in records with the spelling DeForeest and De Forest.[16] Church and land records at Stratford, CT show that the surnames of the next two generations, Samuel and Joseph, were spelled variously as Deforrest, Deforest, DeFreest and De Forest (or DeForest), but never de Forest.

In the next generation was Gideon, Lee's great grandfather. The spelling of his surname is particularly relevant, not only because he was the founder of the branch of DeForests in South Edmeston, NY, but also because the spelling of his name was found in original church records among Lee's personal papers in the Perham collection.

Contrary to what Lee asserted in his autobiography, Gideon's surname is clearly spelled with a capital D in these records—as are those of all of Gideon's relatives (see Fig. 6). Is it possible that Lee actually believed Gideon spelled his name with a small "de?" Not likely. Lee in his own handwriting marked up a 1949 copy of his autobiography in which he inserted "Gideon DeForest" and corrected "de Forest homestead" by replacing the small "d" with a capital "D" (see Fig. 7).

Clearly he was aware that Gideon, his father Joseph and the family homestead in Edmeston were all spelled DeForest, but approved its publication without these and other similar corrections he made to the 1949 copy by replacing the small "d" with a capital "D." That Gideon spelled his name DeForest without a space can be independently confirmed by reliable printed documents,[17] and by Gideon's grave marker where his surname is engraved in capital letters without any space (see Fig. 8).

Did Lee resume the style of earlier generations while at Yale? Putting aside the fact that Lee's earlier generations did not spell their surnames "de Forest" as he claimed, the real issue is whether or not Lee resumed the de Forest spelling while at Yale. There is overwhelming evidence that he did not. Substantial evidence has already been presented that Lee was born with the DeForest spelling and retained that version


FAMILY RECORD.

BIRTHS	BIRTHS	
Died Dec	Dec 9 1847	
Gideon DeForest	Sept 11 1765	75
Hannah Died Bridges	Sept 25 1849	
Died	May 24 1773	72
Abel B. Westbrook	Dec 30 1795	

Fig. 6. The DeForest family birth and death records found among the Marie and Lee de Forest Papers at San José clearly show that Gideon DeForest (top line), his son Abel (third line), and the rest of his family (not shown) spelled their names with a capital "De," not a small "de" as Lee claimed.

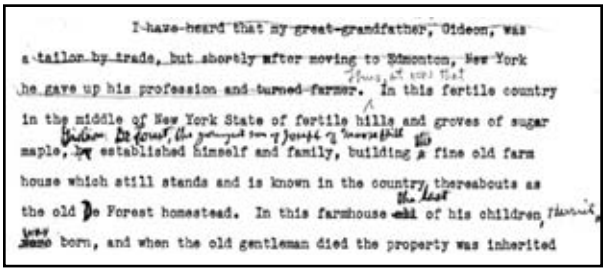

I have heard that my great-grandfather, Gideon, was a tailor by trade, but shortly after moving to Edmonton, New York he gave up his profession and turned farmer. In this fertile country in the middle of New York State of fertile hills and groves of sugar maple, established himself and family, building a fine old farm house which still stands and is known in the country thereabouts as the old De Forest homestead. In this farmhouse of his children born, and when the old gentleman died the property was inherited

Fig. 7. Lee DeForest made handwritten corrections to the 1949 version of his autobiography by inserting "Gideon DeForest" with a capital "De" and replacing the small "d" in "de Forest homestead" with a capital "D," which indicates that he was well aware his ancestors did not spell their names with a small "de"—even though the corrections did not appear in the published version. (Lee & Marie de Forest Papers, H.S.J.)

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Fig. 8. Gideon DeForest's name appearing on his wife's gravestone was spelled GIDEON DEFOREST without a space between the DE and FOREST.

throughout his years at Yale. However, the evidence presented to this point has been restricted to the printed form (as opposed to Lee's signatures) in order to distinguish between DeForest without a space and De Forest with a space. In this section, Lee's signatures will be examined to see if and when he used the de Forest form with a small "de" as opposed to the "De" form—something that can be easily determined from his signatures.

The Lee and Marie de Forest Papers held in the Perham collections at History San José are a rich source of Lee's signatures from his boyhood to later in life. In reviewing the DeForest papers in the Perham collection, it becomes very clear that the overwhelming number of his signatures from Lee's Yale years, primarily on notebooks, notes and letters, have the DeForest signature with the "De" form as opposed to the "de" form.

One example, shown in Fig. 9, is the cover of a notebook that Lee used at Yale in 1896 and that he signed with the "De" form. An even more interesting example consists of a notebook dating from 1899 with what appears to be an adhesive name label engraved with the "De" form of his name pasted to the cover (see Fig. 10). The use of a printed label with the capital "De" form would strongly suggest that he preferred that form. Yet another example, shown in Fig. 11, is an I.O.U. in favor of one Charles A. Fuller signed by DeForest and dated 6/15/99, just as he graduated from Yale. These three examples are typical of the artifacts found in the Perham collection with Lee's signatures covering the last few years he attended graduate school, indicating that he maintained and even preferred the "De" form throughout his Yale years.

The only notable exception to Lee's use of the "De" form of his surname at Yale was in letters to his mother (Fig. 12) where he occasionally used the "de" form in his signatures.[18] This use of the "de" form is a surprise because such a practice would seem to be something of an affront to his parents, who by all accounts were proud of their family name—which was clearly DeForest.

An even bigger surprise is that Lee began this practice, although somewhat intermittently, as early as 1887 when he was only 13 years old—well before he attended Yale. The de Forest signature reproduced in Fig. 12 appears in a letter dated 1887 from Lee to his mother, who was away from the DeForest home in Talladega, Alabama at a location not disclosed in the letter.

The occasional nature of Lee's use of this form is evidenced by another letter he sent to his mother from the Mount Hermon prep

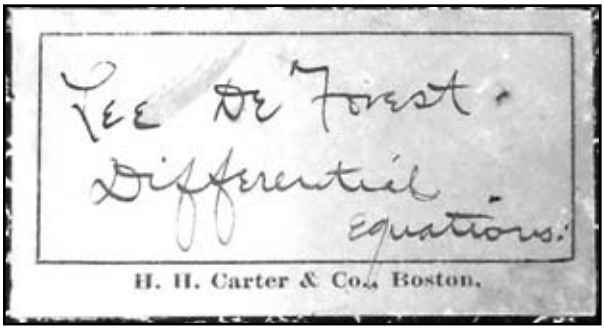

Fig. 9. Most of the notebooks Lee DeForest used at Yale are signed by Lee with the capital "De" form like the one shown here dated 1896, which would indicate he preferred that version. (Lee & Marie de Forest Papers, H.S.J.)

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school with the "De" version of his signature dated 1893. Thus, it cannot be said that he resumed the de Forest style while at Yale on two accounts: 1) he rarely used the de Forest style while he was there, clearly preferring the DeForest style by a wide margin, and 2) he actually began to use the de Forest style long before he attended Yale, albeit intermittently and only with his parents.

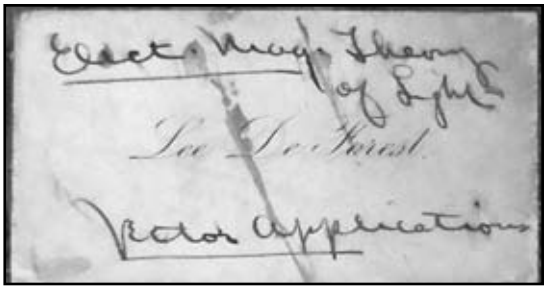

Fig. 10. This particular notebook of Lee's dating from 1899 has a name label with a capital "De" that appears to be a preprinted version, supporting the contention that he preferred the "De" form of spelling. (Lee & Marie de Forest Papers, H.S.J.)

Summary and Conclusions

DeForest never specifically stated any preference for the spelling of his name in his autobiography, or anywhere else for that matter. Nevertheless, many historians have drawn the conclusion from his autobiography that he preferred the de Forest spelling by giving examples of ancestors who spelled their names with the "de Forest style," and then claiming he had "resumed the style of earlier generations" while at Yale.

It has been rather conclusively demonstrated here that Lee DeForest was incorrect on three accounts: 1) Lee was born with the name DeForest, not De Forest (with a space) as he claimed, 2) none of the ancestors in Lee's linage, including Isaac, spelled their name de Forest, despite his claim that "from this union [Isaac and Sarah] sprang the de Forest clan," and 3) Lee did not resume the "de Forest" style of spelling while at Yale.

A multitude of documents and artifacts show that he actually preferred the DeForest form of his name while at Yale — for registration at Yale University, in the byline for his two publications in the Yale Sheffield Monthly, on the masthead of the Monthly when he was an editor, and as the byline on his thesis published in The American Journal of Science just after graduation. Lee's signatures on a large number of documents while at Yale, primarily notebooks, notes and letters, also demonstrate that he clearly preferred the "De" form of spelling.

In searching the DeForest files in the Perham collection, the only substantive use of the "de" form of Lee's signature found prior to his graduation from Yale were on letters from Lee to his parents, and this practice actually began as early as 1887 when Lee was only 13. Thus, it cannot be said under any circumstances that Lee began to use the "de Forest" form while at Yale, much less preferred it.

Even after graduating from Yale, Lee DeForest never "resumed" the de Forest spelling of his name in the sense of a permanent change or a preferred spelling. It will be shown in the next installment that DeForest continued to use the DeForest form of his name almost exclusively for a

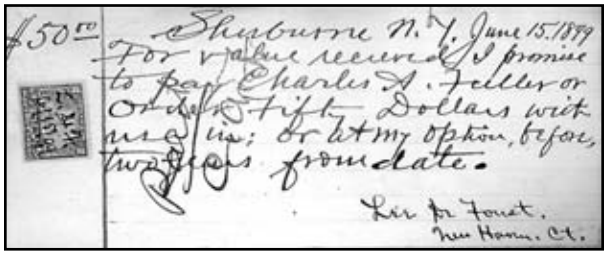

Fig. 11. Lee used the "De" form of spelling in the signatures of most letters and documents he signed while at Yale such as this I.O.U to Charles A. Fuller dated June 15, 1899, the month he graduated. (Lee & Marie de Forest Papers, H.S.J.)

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short time after he graduated from Yale, but after two years he began to use both the De Forest and de Forest spellings under somewhat forced circumstances—in addition to the DeForest form. Actually, he used all three of forms of spelling throughout his life—and rather indiscriminately at that.

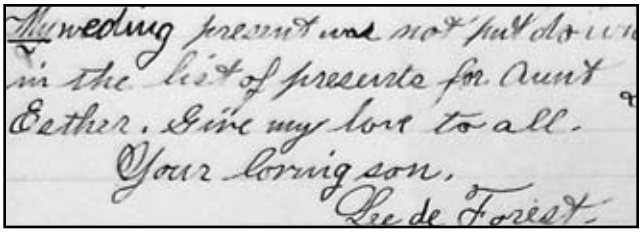
My wedding present was not put down
in the list of presents for Aunt
Esther. Give my love to all.
Your loving son,
Lee de Forest.

Fig. 12. Lee began to use the "de Forest" form of spelling in personal letters to his mother as early as 1887 when he was 13, as evidenced by the closing and signature portion of a letter dated July 5, 1887 from Lee to his mother, who was on a trip away from their home in Talladega, Alabama. (Lee & Marie de Forest Papers, H.S.J.)

Credits

I thank Tom DeForest of Endicott, NY for his hospitality and assistance in photographing the grave markers at Greenwood cemetery in New Berlin, NY and Gazlay cemetery in South Edmeston, NY, and I thank Joe Knight for his assistance during our photographic mission. I also thank the staff at History San José for their hospitality and permission to use six images from the Lee and Marie de Forest Papers (2003-34).

ENDNOTES

1. The play on the word "de" has been taken from the Grammarphobia Blog of July 16, 2010 entitled "What's "de" Story?" This blog explains the usage and history of the so-called nobiliary particle "de."
2. Lee de Forest, Father of Radio – The autobiography of Lee de Forest, (Wilcox & Follett, Chicago 1950).
3. Ibid. pp. 10-13.
4. Catalogue of the Officers and Students of Yale College, 1853-54, (Yale University, New Haven 1853) p. 26. Page numbers in four catalogues covering the remaining academic years cited are: 1854-55, p. 23; 1855-56, p. 20; 1856-57, p. 13; and 1857-58, p. 6.
5. Andover Theological Seminary – Necrology 1880-1881, (Beacon Press 1881) p. 229; 78th Annual Report of the Board of Commissioners for Foreign Missions, Cleveland OH, Oct. 2-5, 1888 (Press of Stanley and Usher, Boston, 1888) pp. 122, 125, 127, 133, 136; Annual Report - American Board of Commissioners for Foreign Missions, Vol. 83, 1893, p. 123; Vol. 84, 1894, p. 126; Vol. 85, 1895, p. 131; Vol. 86, 1896, p. 3; Catalogue of the Alpha Delta Phi (Curtiss & Childs, Utica, NY, 1870) p. 87.
6. The state of Iowa where he was born did not keep birth certificate records back to the year of his birth.
7. Catalogue of the Officers and Graduates of Yale University, 1701-1915, (Yale University, New Haven, 1916) pp. 363, 413.
8. Lee DeForest, "The New Chronoscope," Yale Scientific Mo. Vol. 1, No. 7, Apr. 1895, pp. 326-330.
9. L. DeForest, "Progress in Aerial Navigation," Yale Scientific Mo., Vol. 2, No. 2 Nov. 1895, pp. 49-67.
10. Lee DeForest, "Reflection of Hertzian Waves at the End of Parallel Wires," American Journal of Science, Vol. 8, No. 43, pp. 58-71.
11. Father of Radio, p. 10-12.
12. J.W. De Forest, The De Forests of Avesnes, (Tuttle, Morehouse, & Taylor, 1900) p. 184.
13. Samuel S. Purple, Records of the Reformed Dutch Church in New Amsterdam and New York – Marriages from 11 December, 1693 to 26 August, 1801, (Heritage Books, Bowie, Md., 1997) p. 10.
14. J.W. De Forest, The De Forests of Avesnes, p. 206.
15. Ibid., pp. 105-106, 206-217.
16. It may have actually been DeForest.

(continued on page 53)

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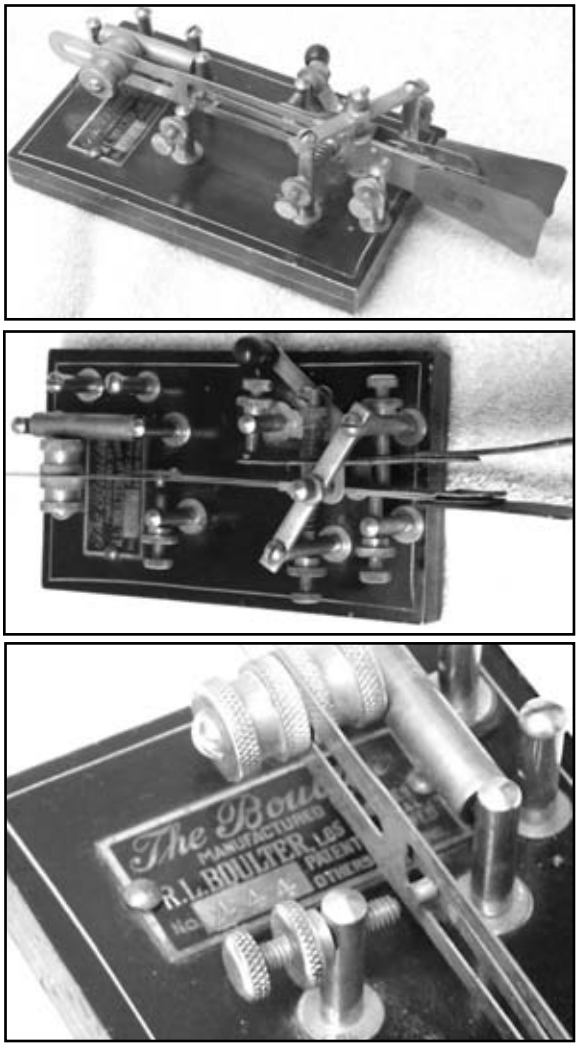
KEY AND TELEGRAPH

EDITED BY **JOHN CASALE**, W2NI, 35 PICKERING LN, TROY, NY 12180,
casalejj@yahoo.com *PLEASE INCLUDE SASE FOR MAIL REPLY.* © 2014, J. CASALE

The Boulder Transmitter

Dan Howard provides us with this article on the very rare Boulter transmitter. James Albright, who owned the Vibroplex Company during this era, felt that the semi-automatic key designs of Royal Boulter were a significant enough threat to those of Horace Martin's Vibroplex that he purchased all of Boulter's patents. —John, W2NI.



Three views of "The Boulter."

By Dan Howard

The Boulter Transmitter's somewhat modern design belies its early origins. And, despite its many similarities to common Vibroplex bugs, it is a seldom-seen example of a semi-automatic key. Here are some notes on the Boulter Transmitter In honor of the key's one hundredth birthday.

The inventor of "The Boulter" was Royal L "R.L." Boulter, born November 2, 1866 in Anoka, MN. He was the son of John Franklin Boulter Jr. and Sarah Woods Lufkin. Sarah died on January 31, 1879, after which John married Emeline Bennett. They had a son, John Floyd Boulter, who was born November 5, 1886 in St. Cloud, Minnesota.

R.L. Boulter married Christina Middlerness on February 25, 1891 in Spokane, Washington. Census records locate the couple in Fresno, CA in 1910. Shortly thereafter they moved to Los Angeles where Boulter was listed as a manufacturer of telegraph keys of his own patented designs.

Boulter patented four designs for telegraph keys between 1912 and 1916. Patent 1,074,831 (filed August 13,

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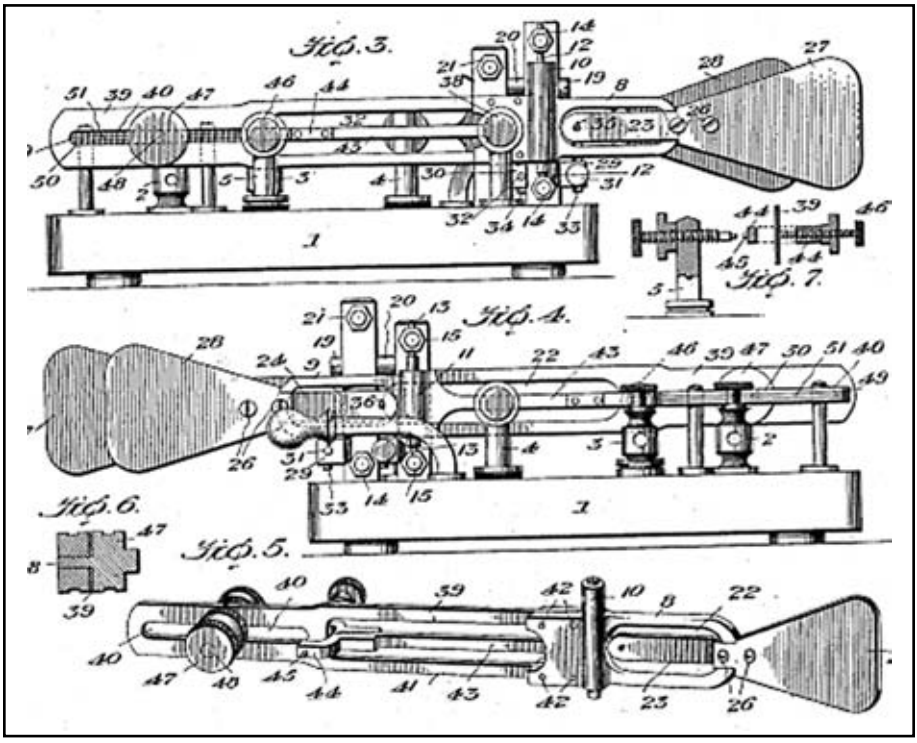
1912) pictures a double-lever design. Patent 1,109,818 (filed March 29, 1912) pictures a double-lever design with a vertical pendulum. Patent 1,110,373, the single-lever design, was filed September 2, 1913. Patent 1,178,291 (filed August 1, 1914) covers improvements to the design patented earlier under Patent 1,074,831.

R.L. Boulter's half-brother, John F Boulter, travelled widely, in connection with his career as a railroad telegrapher and agent. In 1914, he was working for the Southern Pacific near Los Angeles. He moved to Alberta, Canada in 1916 and worked for the Canadian Northern Railroad in Calgary and Vancouver, BC for about two years. Records place him in Mundus, New Mexico working as an agent and telegrapher for the Southern Pacific in 1918. By 1920, he was working for the Southern Pacific in Picacko, Arizona. And in 1930, John was with his wife Anna on the coast in Rockaway, Oregon, again working for the railroad.

John would have been in his mid 20s and employed as a telegrapher near Los Angeles about the time that his half-brother RL Boulter began patenting telegraph key designs. A 1914 news item in *The Railroad Telegrapher* magazine announced that John was a sales agent in Los Angeles selling Boulter Transmitters.

James Albright purchased R.L. Boulter's company, and its patents, for the Vibroplex Company some time in the mid to late teens. Tom Perera's website pictures a Vibroplex Vertical "Line Chief's" key, circa 1918, whose label lists all four Boulter patents. An Original model Vibroplex from 1919 pictured on the site also lists the patents. With its flat lever and assembled frame, the Vibroplex #6 "The Lightning Bug" (first manufactured about 1927) has the closest resemblance to the Boulter Transmitter. However, no Vibroplexes utilized Boulter's unique side-mounted

(continued on page 52)



Drawing from R.L. Boulter's Patent #1110373 of September 2, 1913.

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RADIO RAMBLINGS

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Expanding Radio Frequency Frontiers

In the late 1880s, Heinrich Hertz, a German physicist, used VHF/UHF laboratory apparatus to prove the existence of electromagnetic waves that had been predicted by James Clerk Maxwell. But the desire for long distance communications required a different approach. For that reason, early development of radio focused on longer wavelengths. During the first two decades of the 20th century, radio communications was conducted in the low and very low frequency ranges. Radio operators became convinced that lower frequencies were necessary for longer distance communications and assumed that shorter wavelengths would have few practical applications.

That preference for longer wavelengths was still evident when more regulation of radio frequencies became necessary after commercial broadcasting began in 1920. Herbert Hoover, U.S. Secretary of Commerce, formed the Radio Telephone Committee which included representatives of all users of radio communications. The July 1922 issue of *Radio Broadcast* magazine included a list of their recommendations.

Twenty-one ranges of wavelengths, from 6,000 meters to 100 meters, were to be allocated to various radio services. Only six of these ranges were for wavelengths shorter than 500 meters. These recommendations included the notation that all wavelengths below 100 meters were "reserved." Apparently 100 meters, or 3 MHz, was considered to be the radio frequency frontier in 1922.

Amateur radio communications had been suspended during World War I. When it was reauthorized after the war, frequencies were greatly restricted to avoid interference with other radio services. In his famous book, *Two Hundred Meters and Down*, Clinton B. Desoto describes the challenge that amateur radio operators felt with these new restrictions. But soon they discovered that high frequency operation provided some interesting benefits, including "daylight DX" on wavelengths as short as 20 meters.

The limitation of radio frequencies that were being used in the early decades of radio development resulted in some interesting situations. The February, 1924 issue of *Radio Broadcast* magazine included an article titled "When Cowboys Heard Bedtime Stories." It describes the first time anyone had successfully received radio broadcast signals on the north rim of the Grand Canyon. This had been considered a "radio dead zone" since 1917 when the United States government failed to establish radio communication between Bright Angel Point on the north rim with a similar station on the south rim, a distance of only 13 miles.

During the later 1920s, significant developments continued in high frequency or "short wave" communications. Vacuum tubes available at that time worked well in the lower part of this frequency range, but their performance became marginal above 15 MHz By 1930, the frequency frontier had advanced to 30 MHz.

During the 1930s, radio equipment was developed to operate at VHF frequencies. On a hilltop near the town of Genoa, Colorado, is a lookout tower that was constructed in 1927. It was originally known as the "Wonder Tower," claiming that visitors could see six states from this location. When I visited that tower in the 1990s, I noticed a newspaper article posted on the second floor that described how two amateur radio operators used this tower in the mid-1930s to demonstrate VHF radio communications with a station on Pike's Peak, more than 100 miles away. The frequency used for this test was approximately 60 MHz. I stopped again at the Genoa Tower in May 2014 to take the photo that appears with this article. This historic tower closed after the owner died in 2013.

The "Wonder Tower" near Genoa, Colorado.

Reading radio publications from the 1930s can be confusing because the definitions of "VHF" and "UHF" had not been precisely defined as they are today. Frequencies in the VHF range were often referred to as "ultra high" or "ultra short wave" even though we now use the prefix "ultra" to define frequencies from 300 MHz to 3 GHz as being in the UHF range. *Short Wave Radio* and other magazines from the 1930s used "ultra high frequency" to describe radio equipment operating at 100 MHz.

Technical developments before and during World War II expanded the frequency frontier. Early FM broadcasting was in the 42-50 MHz band, but this was reassigned to its current 88-108 MHz band after World War II. Early radar systems operated at VHF frequencies but later expanded into the UHF range.

To operate at VHF and UHF frequencies, better vacuum tubes were developed to reduce internal capacitance and inductance. I photographed three of these tubes in my collection for this article. The 15E tube was used in early radar transmitters, possibly including those used in the British "Chain Home" system that warned England of approaching German bombers during the Battle of Britain. The 957 "acorn" tube, and similar types, were used for many UHF designs during and after World War II. The innovative 2C40 planar triode "lighthouse" tubes were also used in UHF equipment. The elements in this tube are arranged vertically instead of concentrically as they are in conventional tubes.

Other tubes invented for higher frequency operation include the klystron, used today in the final amplifiers of UHF television transmitters, the cavity magnetron that could produce the high power pulses that were needed for radar systems, and the traveling wave tube which pushed the frequency frontier beyond UHF. Traveling wave tubes were used in the Telstar communications satellites that were designed by Bell Telephone Laboratories and launched in 1962 and 1963.

By the time I was studying for my amateur radio license in the early 1960s, the official frequency frontier was "30,000 MHz and above." That seemed like an impossible frequency to even consider, but today we are using even higher frequencies for deep space communications.

The frequency frontier for transistors lagged far behind that of vacuum tubes. Although bipolar junction germanium transistors were invented in 1947, their future as RF amplifiers did not look promising. Many transistors in the early 1950s could not provide amplification above one megahertz. When Texas Instruments designed the famous Regency TR-1 transistor radio, first sold in late 1954, they intentionally used a low IF frequency to avoid this problem. They had to hand-select the front-end transistors to allow the radio to perform well in the AM broadcast band.

In the 1960s it appeared that gigahertz frequencies would be dominated by vacuum tube amplifiers far into the future. Even the best silicon transistors were only able to provide amplification at frequencies in the lower UHF range. But recent developments in solid state device research produced two new transistor designs that are bridging that gap.

Gallium Arsenide transistors were developed for the cell phone market, and are also widely used for cable television amplifiers. They can operate well at gigahertz frequen-

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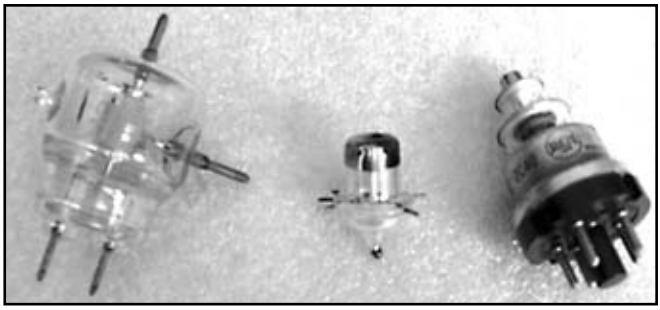
cies, but their power output is limited to a few watts. Gallium Nitride transistors were developed to meet Department of Defense specifications. They are more expensive and difficult to produce, but they can provide UHF power outputs in the 10-100 watt range.



VHF and UHF tubes from The author's collection. From left: 15E radar tube; acorn tube; lighthouse tube.

A review of recent electronics publications suggests that the frequency frontier is now above 100 GHz. The July 2012 issue of *Microwaves and RF* magazine featured a vector network analyzer that can operate at frequencies up to 125 GHz.

The next challenge is to expand the frequency frontier by another order of magnitude into the terahertz (1,000 GHz) frequency range. Terahertz frequencies have some interesting properties. Their huge bandwidth can provide data transfer at amazingly high rates. They also have the possibility of being used as a non-ionizing substitute for X-rays in security applications.

But the development of practical terahertz equipment operating at wavelengths of less than one millimeter is a design challenge for the future. A recent article in *IEEE Spectrum* magazine described a laboratory test that attempted to produce terahertz signals by mixing two laser beams of different frequencies. The difference between the two laser frequencies approached the terahertz range. When that challenge has been solved, we can say that we have mastered the electromagnetic spectrum from "DC to light!"

KEY & TELEGRAPH, *cont. from page 49*

damper mechanism. Speed adjustment on the Boulter is accomplished by a pair of weights that slide in a slot in the lever, another unusual feature.

Over the years, machinists have crafted some beautiful examples of Boulter designs from the detailed drawings in the patents, and pictures of their work can be found on the web. However, only the single-lever Boulter Transmitter is thought to have been made commercially. The known serial numbers range into the 400s, but only a handful of examples are documented. *(Serial #216 was sold on eBay in August of 2013. —J.C)*

Boulter Transmitters are finished in a beautiful dark maroon paint, possibly japanning, with gold pinstriping on the sides and top. Hardware is all finished in nickel. The finger tabs on our example may be replacements. The key measures 6" × 3½" × ⅝" and fits perfectly in a spare Vibroplex carrying case we had on hand.

If you have any additional information to share about the Boulter Transmitter, please let us know!

SOURCES:

The Railroad Telegrapher Vol 31. No. April 1914, pg. 661 (from Google Books).
http://W1TP.com/
Lynn Burlingame, N7CFO
U.S. Census records
U.S. Patent records
http://www.ronayling.dsl.pipex.com/keys10/more_on_morse_keys10.html (images of Boulter reproductions)

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CLASSIFIED ADS

Old-time ads are free to members collecting and restoring equipment for personal use. The AWA Journal *classified ads are also available for browsing in the* "AWA Journal On Line Edition" *on our Internet Web site (www.antiquewireless.org). Please observe the following: (1) include as SASE if acknowledgement is desired; (2) material must be more than 25 years old and related to electronic communications; (3) give your full name, address and zip code; (4) repeats require another notice (we are not organized to repeat automatically); (5) the AWA is not responsible for any transaction; (6) we retain the right to reduce an ad's size if over seven lines; and (7) closing date is six weeks prior to first day of month of issue. Ads received after that time will be held for the following issue. Mail all ads to: RICHARD RANSLEY, 25 Smith St., Sodus, NY 14551-1007 or email to richardransley@ mac.com.*

SELL/TRADE—GENERAL

Magnutrol (Magnus Electric Company) 3 dialer battery set; Atwater Kent Model 20 battery set; RCA 100A speaker; Atwater Kent Model 46 TRF; Atwater Kent F-2 (for Model 46); Barawik single dial TRF in metal case. John Zima, 1360 Reed Road, Churchville, NY 14428 JFZ_RHY@ yahoo.com

SELL/TRADE—MILITARY

Dynamotors: ARC 14482, Type DMX310, 28VDC, 2 EA DY-86/ARN-30; 1EA D-10A (28v) Type OS-200, 14 VDC, Type DM21B, 14 VDC; Radio Receiver, R19/R-508/ARC aircraft radio, 119-148 MHz, with attached DMX310 dynamotor; Radio Receiver type BC-348-O, without modifications; Radio Receiver, Type RBM, 200-360 kHz, 360-650 kHz; 1140-2000kHz; Rectifier power unit, CTT- 20086, for RBM receiver. John Zima, 1360 Reed Road, Churchville, NY 14428 JFZ_RHY@ yahoo.com

SELL/TRADE—TUBES/TRANSISTORS

Specialty tubes: CK5702 subminiature pentodes, Dumont #6292 PMT, 3BP1 3" CRT; 3CP1 3" CRT, FX-1 EG&G straight flash tube; 1D21 Sylvania; 1P39 RCA photodetector; 1P40 photodetector; CE-18D Centron photodetector; 1B59 Sylvania photodetector; GL917 RCA photodetector; GL919 photodetector; 5819 photodetector; 931A photodetector. John Zima, 1360 Reed Road, Churchville, NY 14428 JFZ_RHY@ yahoo.com

WANTED—LITERATURE

Want September 1935 issue of *Electronics* magazine. Derk Rouwhorst, Noorderhagen 56, 7491AS Delden, Holland. derkrouwhorst@ hotmail.com

WANTED—MILITARY

WWII military RBL-3 or 5 series low frequency receiver. 15 kHz to 600 kHz. John Zima, 1360 Reed Road, Churchville, NY 14428

DE FOREST, *cont. from page 47*

Church records, which were usually created in cursive writing, were often improperly reproduced in print by retaining the space after De that appeared only in cursive writing.

17. Proceedings of the Grand Lodge of Free and Accepted Masons of the State of N.Y., (J.J. Little & Co. 1905) p. 123; C.T. Peet, John Peet, 1597-1684, of Stratford, Connecticut & His Descendants, 2005, p. 48.
18. A service card for Lee's participation in the Spanish American War as well as his discharge papers dated Oct. 25, 1898 have "de Forest" in cursive writing, but not in his handwriting. However, his name appears as both DeForest and De Forest in Record of Service of Connecticut Men…in the Spanish-American War, (Case, Lockwood & Brainard, 1919) pp. 162, 213. Whatever form he used will not change the conclusions.

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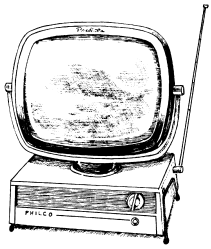
TELEVISION



EDITED BY **RICHARD BREWSTER**, 145 LITTLE PECONIC BAY ROAD, CUTCHOGUE, NY 11935 *PLEASE INCLUDE SASE FOR REPLY.*

Zworykin's Electronic TV Receiver

Vladimir Zworykin worked for Westinghouse from 1920 until he left to join RCA in early 1930. Toward the end of that time his work was being funded by RCA at the direction of David Sarnoff. In 1929 he was able to demonstrate what was in all certainty the first electronic television receiver. Zworykin's work on that set was featured in the December 1929 issue of Radio Engineering. But no schematic was shown. Since reading that article, I had been eager to see a schematic.

In September 1996, I had the honor of sponsoring television historian Albert Abramson to receive the AWA Taylor Television award at the AWA Annual Convention. He is the author of two excellent books: *Zworykin, Pioneer of Television* and *The History of Television, 1880 to 1941*. I corresponded with Albert for some time before and after the Convention and he subsequently sent me, among other items, an unusual schematic. Just recently, I took a closer look at that schematic and got the surprise of my career as a TV historian!

Zworykin demonstrates his electronic TV (1929).

The schematic, shown here, is of that famous set, the first electronic television receiver. It was hand-drawn and signed on October 10, 1929 by one of Dr. Zworykin's assistants, Harvey Iams. Iams titled the schematic "Wiring of 1st cabinet Television Receiver." The team also included Randall Ballard, who designed the radio receiver, and Arthur Vance, who designed the video amplifier, deflection circuit, and high voltage supplies. The kinescope envelopes were manufactured by Corning Glass and made into green phosphor picture tubes by John Batchelor and A.J. Harcher.

A Simplex movie projector incorporating a photocell in a mechanical scanning arrangement with an oscillating mirror generated the picture signal. Horizontal scanning used a sine wave while vertical scanning was linear. The image transmitted consisted of 60 lines at 12 frames per second. The video was sent by landline to the KDKA station and transmitted on the 150-meter band. The synchronizing pulses were also sent by landline and transmitted on 90 meters. (A later design combined the video and sync.) Zworykin was able to use the two KDKA transmitters between 2 and 3 A.M for his experimental broadcast.

At the receiver, a filter separates the horizontal and vertical sync signals. A type 227 driving a 250 provides the vertical 'framing' sawtooth which feeds the external vertical deflection plates. A tuned circuit feeds the 'pentode', driving the horizontal deflection coils with a sinusoidal waveform. The kinescope screen diameter was 7 inches.

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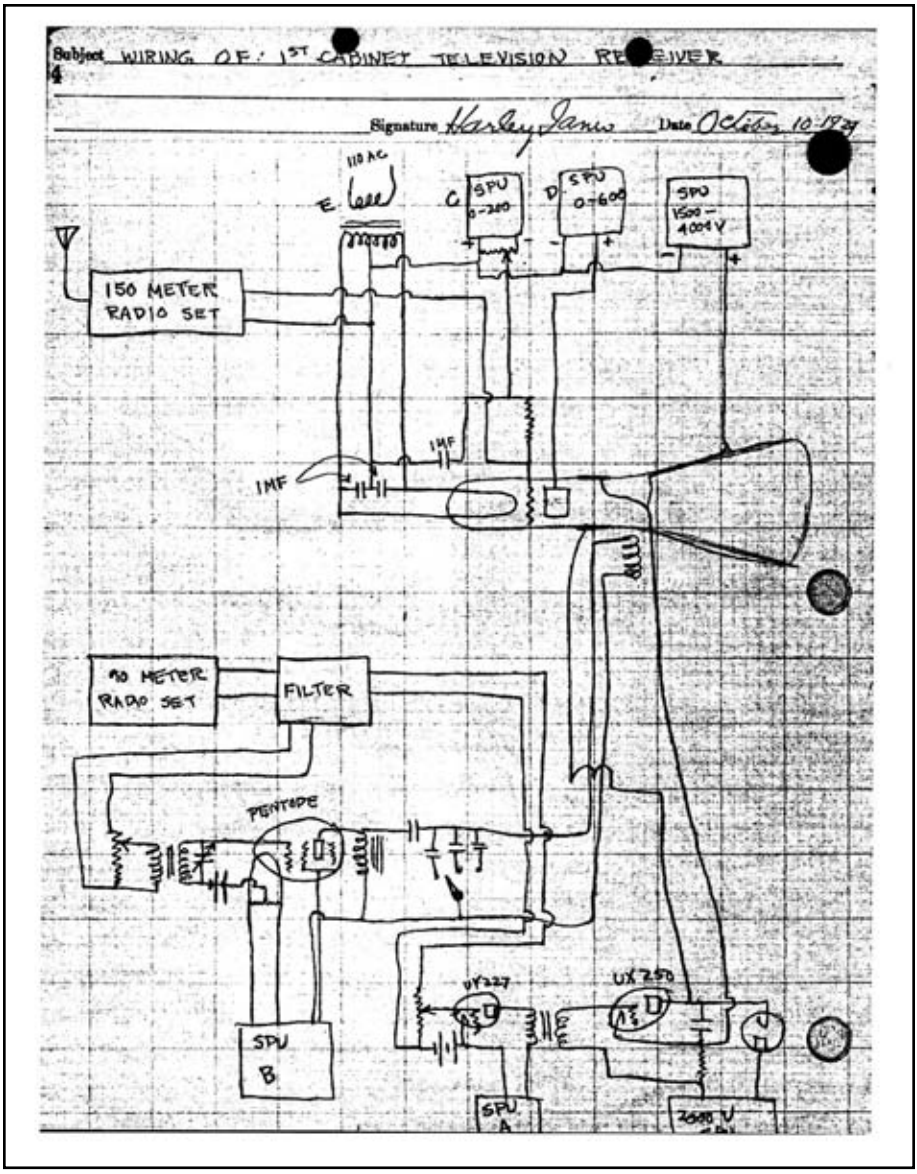

The electronic TV schematic as drawn by Iams. The quality is poor, but it is the only copy now known to exist.

Zworykin had one of his electronic television receivers installed at his home, about 4 miles from the KDKA transmitter, where he claimed to be able to receive the pictures 'quite well'. Six of these sets were made. I wonder if one of them still exists?

REFERENCES

Zworykin, Pioneer of Television by Albert Abramson

History of Television, 1880 to 1941 by Albert Abramson

Radio Engineering, December 1929

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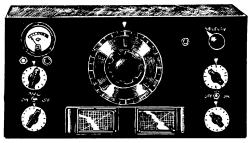
THE COMMUNICATIONS RECEIVER



BY **BARRY WILLIAMS, KD5VC**, 2002 MUSTANG LANE, ROSHARON, TX 77583
E-MAIL: hroengineer@gmail.com

HROs For the UK Military

The HRO-5 was the produced by National for service during the Second World War, primarily in the UK. It was an improved HRO-MX using metal vacuum tubes with octal bases with the exception of the final audio amplifier, a glass 6V6G with an octal base. The metal 6V6 was apparently not produced until after 1946. This tube complement replaced the large glass tubes and shields used in the earlier HROs. It included four 6K7s, three 6J7s, a 6SQ7 and the 6V6G.

The HRO-5 was produced for military use, primarily by the British, during World War II.

The 6K7s were used as RF and IF amplifiers, the 6J7s were used as the HFO, BFO, and Mixer, the 6SQ7 was a dual diode-triode used for the Detector and AVC rectifier as well as the first audio amplifier. The metal tubes were more rugged and eliminated the external metal shields required by the earlier glass tubes. Those shields were often lost, allowing feedback and reducing stability. This was probably noticed at repair depots during World War II.

In discussing HRO models with enthusiasts in the United Kingdom, you will find that if they acknowledge any difference at all, they will normally mention only the "Glass Valve HRO" and the "Metal Valve HRO". Actually, both the HRO-M and MX used glass tubes.

The front panel of the HRO-5 introduced bright metal rings around the AVC and B+ switches that were silk-screened with markings to indicate switch position and function. Also introduced was a flanged knob with skirt for the selectivity control, matching the other flanged knobs on the panel and giving a more pleasant appearance. The National tags usually indicate HRO-5T for table models or HRO-5R for rack models.

An HRO-5 will have one of two styles of coil. The earlier version is similar to that provided for the HRO-M and MX. It includes a paper graph showing dial reading versus frequency and a paper logging grid—each overlaid by a plastic window. In the later version, the frequency-to-dial reading graph and the logging table are silk screened on a silver background.The company's stock of older coil sets was used up prior to switching to the later, silk screened version. The later coils are often referred to as "Silver Front Coils". These were typically tagged as "R-106 Mark II" in the U.K.

The HRO-W was the last HRO model produced by National for the U.K. military. These receivers were produced on contract near the end of World War II for use in the Pacific theater of operations. They are quite similar internally to the HRO5T.

The primary difference in the units I have seen is that the S-Meters are typically cali-

brated for 0-1 mA and they are treated with fungicide for tropical use. They also seem to have a bit more gain than the HRO-MX. This gain was adjusted by a resistor selected at manufacture, and it is possible that for use in the Pacific theater the resistance to strong signals and jamming was expected to be less of a problem than in Europe. The HRO-W came with modified power supplies that were rectangular, not the "dog house" shaped supplies provided with earlier units and they were "tropicalized."

HRO-5TA1 early (top) and late versions. Note difference in signal strength meters (see text).

The production of these receivers began in mid-1945 and most were apparently not shipped to the military, but sold to the public after the end of World War II. The precipitous ending of the war with Japan left National with a large stock of these units. The dates of the application of fungicide were usually in the July to September 1945 range.

After the war, one of the National full-page technical advertisements in QST discussed the suitability of these units for radio amateurs. Most have six of the "Silver Front" coils as seen with some of the late HRO-5s, and some have all nine coils. The 6-coil set was designated "JA, JB, JC, JD, JE and JF" and provided coverage from 480 kHz. to 30 MHz. The additional three coils, covering 50 kHz. to 430 kHz, were designated as "G, H and J."

The square power supplies, designated "697-W," are of very high quality. The electrolytic capacitor is a plug-in unit and the covers are attached with quarter turn fasteners. These units run quite a bit cooler than the type "697" doghouse supplies.

After the end of World War II, the situation gets a little murky. According to the manual covering the HRO-5, the HRO-5A was an HRO-5 with four standard HRO-Sr coils having band spread capability on the 80, 40, 20, and 10 meter bands. This feature would have been needed for the wartime intercept receivers. The manual also has an addendum showing the HRO-5A1 with the noise limiter mounted on the main chassis, and a round S-Meter. The noise limiter used the 6J5 triode and a 6H6 dual diode clipper.

The lack of ads released between September of 1945 and January 1946, and the fact that the manual covering the original HRO-5 also covers the HRO M and MX, with supplements for the 5A and 5A1 receivers make the actual production estimates very difficult. As it appears from the above, the HRO-5 and HRO-W were issued in stages near the end of the war, with the "5" (to be used in the European theater) pre-dating the "W" (to be used in the Pacific theater) by at least a year.

In visiting museums in the U. K. I saw both HRO-5T (table) and HRO-5R (rack mount) models, but no HRO-W models. One HRO-5R was identified as having come from a light (escort) carrier. So the HRO-5 was not strictly an army model but, along with the HRO-W, served also in the navy.

Apparently the HRO-W did not sell in the commercial market as well as National required, so the company converted HRO-

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An HRO-5TA1 as factory-converted from an HRO-W.

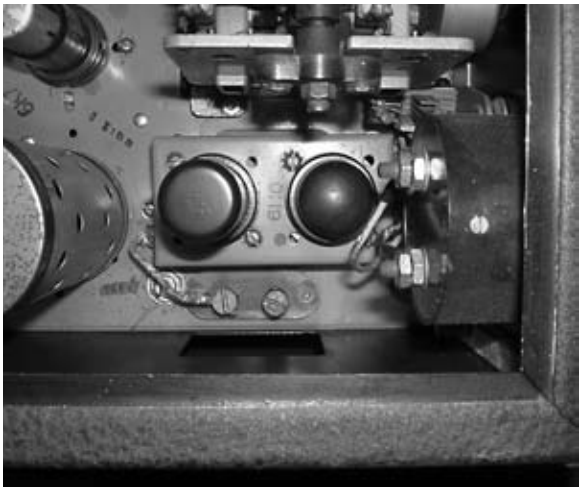
Ws to HRO-5TA1s. These are identified by having the noise limiter mounted on a sub chassis above the main chassis and under the S-Meter. The conversion included replacing the 0-1 mA received strength meter with an S-Meter, and the provision for four band spread capable coil sets.

These conversions seem to have mostly used the existing HRO-W cabinets. The converted cabinets will have four holes where the "Receiving Set R106 Mk III" tag was removed. The HRO-5TA1 tag is mounted just to the right of the S-Meter. These are seen in 1946 ads by National, where they are simply identified as HRO-5TA1.

I have seen an HRO-W converted chassis with a standard HRO-5TA1 cabinet having with the tag on the right side of the front panel. I have also seen an early model HRO with round IF cans and black chassis that was shipped back to National for conversion to a 5TA1. It also had the additional noise limiter chassis on top of the main chassis.

The last version of the 5TA1 used a square S-Meter and the noise limiter was mounted on the main chassis. It also used a plated chassis and a new crystal filter (easily identified as the Phasing and Bandwidth control are inverted when compared to the first model 5TA1). These are my favorites of the HRO line, you can see the lineage back to the 1934 prototype: black wrinkle paint, the same dimensions for the cabinet, and that lovely dial, though converted from German Silver to glossy black.

I use an external voltage regulator between the supply and receiver to limit the voltage to 180 volts DC, thereby removing the drift caused when changing the gain of the receiver. In the late 1940s, National made a special run of 15 meter bandspread coils for the 5TA1 (also fitting earlier HROs). These are rare today, but useful, as the gain and internal noise are still favorable at 15 meters, though the performance at 10 meters is not great.



In 5TA1 models converted from "W" sets, the noise limiter was mounted on a sub chassis above the main chassis and under the S-Meter.

In 1947 National brought out the HRO-7 with a gray paint scheme and "modern" styling. The first of these used a 5TA1 chassis with a plate over the HF oscillator tube location. On the plate were mounted a pair of 7 pin miniature sockets for a voltage regulator tube and a 6C4 oscillator that replaced the earlier electron coupled 6J7 oscillator.

Any one of these fine receivers should make its owner quite happy.

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Do You Know?

HORIZONTAL

1—A famous name in the radio world.
7—A part of some AUDIONS.
10—Where the De Forest AUDIONS are known.
11—The home of sound waves.
13-14—Equip your ...with De Forest AUDIONS this.....
15—Essential part of an antenna.
16—Present in storage battery cells.
17—A prefix pertaining to an activity almost as popular as radio.
19-20—How one feels when using De Forest AUDIONS in their set.
21—Good Oxide Coating. Abbr.
22—The innermost part of anything.
23—Devices for tuning.
25—Manuscript. Abbr.
26—Atom containing electric charge.
27—What De Forest AUDIONS do to your tube troubles.
28—What the AUDION did to your approval.
30—Conjunction.
31—An essential of a radio tube that the De Forest AUDION insures nearly perfect.
32—Screen-like electrode of an AUDION.

VERTICAL

1—The scanning mechanism of a television set.
2-3-4—Synonym of 1 Horizontal.
5—This is a radio.....
6—Television Engineer. Abbr.
7—Where the first AUDION was made.
8—De Forest AUDIONS are free of all fluids of this type.
9—What the AUDION is to all other radio tubes.
12—Part of verb to be. Poetic.
17—A Vacuum tube.
18—Genuine. As a DeForest tube.
22—A variety of speaker.
23—What a set is apt to do when not equipped with De Forest AUDIONS.
24—Conjunction.
28—Prefix much used in radio terms.
29—Amplification factor. Symbol.
30—Hypothetical force.

Write De Forest Passaic, N. J., **DeForest** *Radio Company for solution.*

AWA Librarian Jim Kreuzer recently sent along this DeForest crossword puzzle from the archives. It dates from about 1928. No, we don't have the answer key—but if an intrepid reader comes up with one, we'll publish it in an upcoming *Journal*!